NAVSHIPS 92911(A)
VOLUME 1 of 2

TECHNICAL MANUAL

for

RADIO SET
AN/MRC-55

SECTIONS 1 THROUGH 7

Federal Telephone and Radio Company

A Division of INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

Clifton, New Jersey, U.S.A.

DEPARTMENT OF THE NAVY

BUREAU OF SHIPS

Contract: NObsr-71017 *Approved by BuShips: 18 December 1958*

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From: Chief, Bureau of Ships
To: All Activities concerned with the Installation, Operation, and Maintenance of the Subject Equipment

Subj: Technical Manual for Radio Set AN/MRC-55, NAVSHIPS 92911(A)

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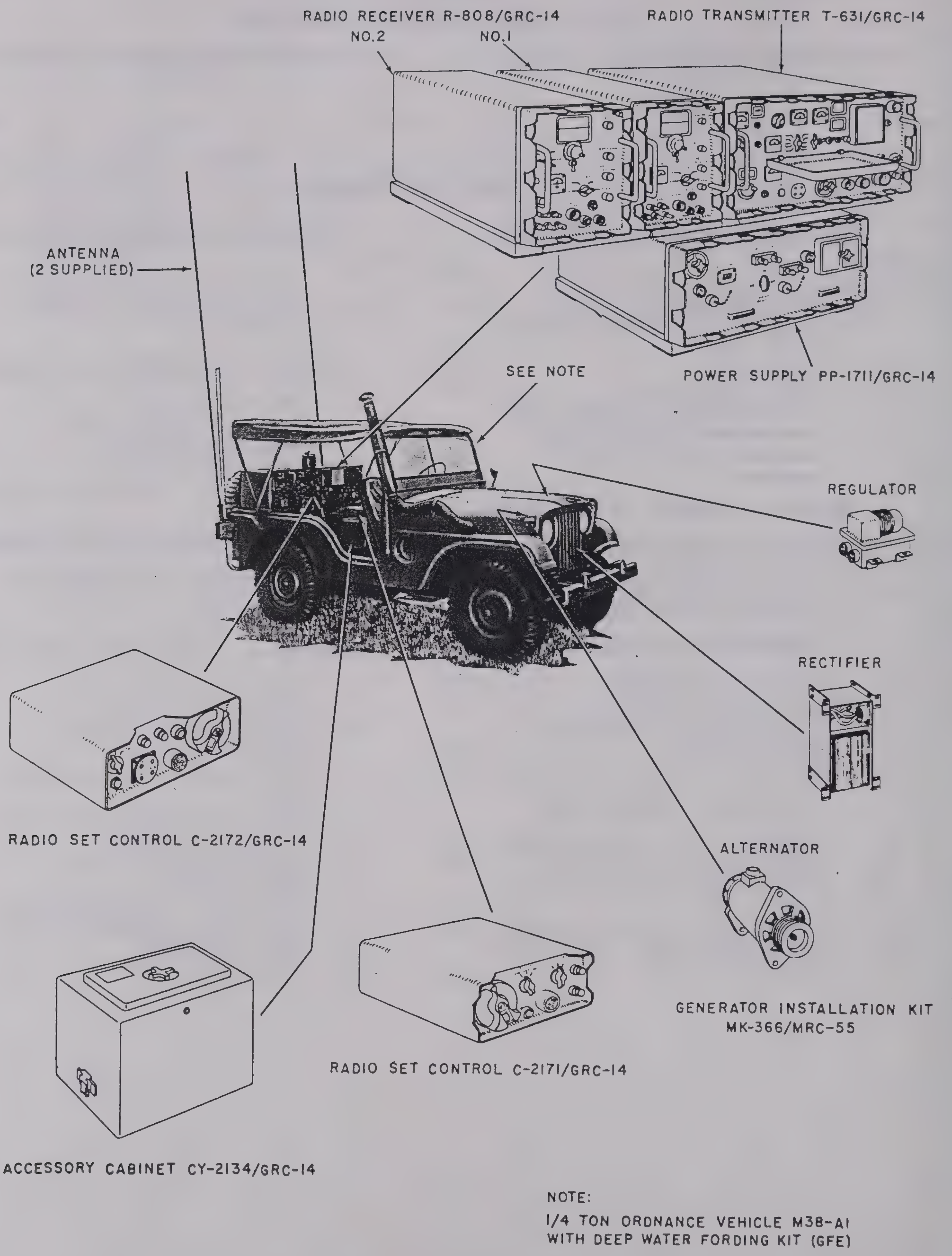

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SECTION 1
GENERAL DESCRIPTION

1-1. INTRODUCTION.

This technical manual covers the theory, installation, operation, and maintenance of Radio Set AN/MRC-55.

1-2. PURPOSE AND BASIC PRINCIPLES.

a. PURPOSE. — Radio Set AN/MRC-55 is designed to provide two-way, high-frequency radio communication at either a fixed or mobile installation.

Note

The nomenclature assigned to identify the equipment for general ground use (fixed installation) is Radio Set AN/GRC-14. When Radio Set AN/GRC-14 is used with Generator Installation Kit MK-366/MRC-55 in a 1/4-ton Ordnance Vehicle M38-A1, the complete equipment (mobile installation) is designated Radio Set AN/MRC-55.

The radio set is capable of the transmission and reception of phone, cw, and frequency-shift keying; and the reception of modulated cw. The equipment transmits within the frequency range of 2 to 30 mc and receives through the range of 2 to 32 mc. The transmitter portion of the equipment covers its frequency range in steps of 100 cps with a nominal 100-watt output level, while the receiver portion is continuously tunable from 2 to 32 mc. Radio Set AN/MRC-55 operates either from its own vehicular power supply or from an external power source.

b. MODES OF OPERATION.

(1) TRANSMISSION.

(a) Radiophone (A3), amplitude modulation, using a push-to-talk method for transmission.

(b) Telegraphy (A1), cw key or cw teletype emission, using break-in keying facilities.

(c) Telegraphy (F1), frequency-shift keying (fsk) teletype with a carrier shift of ±500 cycles, using either neutral or polar keying.

(d) Facilities are provided for simultaneous transmission of radiophone and fsk teletype.

(2) RECEPTION.

(a) Radiophone (A3), amplitude modulation.

(b) Telegraphy (A1), cw key or cw teletype.

(c) Telegraphy (A2), modulated cw (mcw).

(d) Telegraphy (F1), frequency-shift keying (fsk), using internal frequency-shift converter; operating with either neutral or polar teletypewriter.

(e) Facilities are provided for simultaneous reception of radiophone and fsk teletype on the same frequency.

(3) RELAY OPERATION. — The radio set can be used as a relay station (communications link) for automatic retransmission of received radiophone signals.

c. TUNING PROCEDURES. — The receiver portion of Radio Set AN/MRC-55 is manually operated and tuned directly on the receiver front panel. The transmitting equipment is semiautomatically or manually tuned. Tuning is accomplished with a minimum number of operating controls located on the front panels. All operating and tuning controls on both receiver and transmitter are arranged to permit easy and rapid operation. When the transmitter has been set up for a selected operating frequency, tuning of the rf amplifier stages and antenna tuner is automatic. Time required for the automatic tuning portions of the equipment to function is approximately 30 seconds.

d. FREQUENCY SELECTION. — Transmitter frequency is selected by means of six direct-reading front-panel knobs, and is stabilized by locking a variable-frequency oscillator (vfo) to a reference oscillator with a front panel meter. The vfo is provided with a 0-100 calibration dial and associated calibration charts. Rotating drum-type counters are provided for other tuned circuits in the transmitter. The receiver is tuned directly on the front panel, and the selected frequency is displayed on an illuminated calibrated dial.

e. REMOTE OPERATION. — The equipment can be operated from a local remote or a field remote location. At the local remote location, push-to-talk and interphone facilities are provided at the radio operator's position in the vehicle. At the field remote location (up to one mile from the transmitting equipment), push-to-talk, interphone and cw keying with break-in facilities are provided. Remote control of the dynamotor is another feature of the control group.

f. PRIMARY POWER SUPPLY. — The receiving and transmitting equipment may be operated either from a 27.5-volt dc and 24-volt rms primary power source from the vehicle generating equipment, or from an external 115-volt, 60-cycle, ac source. (The 24-volt supply is required only for teletype operation.)

1-3. DESCRIPTION OF UNITS.

Figure 1-1 shows the major units supplied with Radio Set AN/MRC-55 and table 1-1 lists the equip-

ment supplied with the radio set. Equipment required but not supplied with the radio set is listed in table 1–2; shipping box numbers, crated weights, and dimensions are given in table 1–3; the official nomenclature, common name, and reference symbol group for each major component and subassembly in the radio set are listed in table 1–4. Table 1–5 lists the electron tube, transistor and diode complement; table 1–6 lists the crystal complement.

a. RADIO TRANSMITTER T–631/GRC–14. The radio transmitter (figure 1–2) consists of a watertight cabinet (transmitter cover) housing a front panel and the transmitter main chassis. The transmitter main chassis is mounted in a sealed cabinet retained by front panel fasteners. Ventilating louvers may be closed to make the unit submersion-proof. All indicators, controls, and connectors are mounted on the front panel. The blower, antenna transfer relay and intake air filter are mounted as integral components in the main chassis. The main chassis also contains the following subassemblies capable of independent removal and replacement:

- Frequency Generator Units
  - Variable-Frequency Oscillator
  - Reference Oscillator and Mixer
  - Mixer-Stabilizer
- Audio-Frequency Amplifier
- Amplifier-Modulator
- Keyer Group
- Servo Control
- Radio-Frequency Tuner

Each of the subassemblies is provided with facilities for interconnection to the transmitter main chassis. In addition, the main chassis contains a protective power interlock switch.

(1) FREQUENCY GENERATOR UNITS. — Three removable subassemblies comprise the frequency generating section of the transmitting equipment: the variable frequency oscillator (vfo), reference oscillator and mixer, and mixer-stabilizer. The vfo is located on the bottom left front of the transmitter main chassis; the reference oscillator and mixer is located on the bottom right front of the main chassis; and the mixer-stabilizer is located on the bottom right rear of the main chassis between the keyer group and the servo control.

Frequency generation in the transmitter involves the use of a free-running oscillator operating at the output frequency of the transmitter. Accuracy of the variable master oscillator is maintained by comparing its output with the reference oscillator and mixer, providing a stable frequency source. Failure of the reference oscillator and mixer will still permit transmitter operation as a tunable-oscillator, power amplifier-type transmitter on all services except fsk. The mixer-stabilizer provides automatic frequency control for the vfo. Selection of transmitter operating frequency is controlled by a decade system of six knobs on the front panel of the equipment. Detachable couplers, connecting rotary switch shafts to the knobs on the front panel, provide control of rotary switches in the individual units.

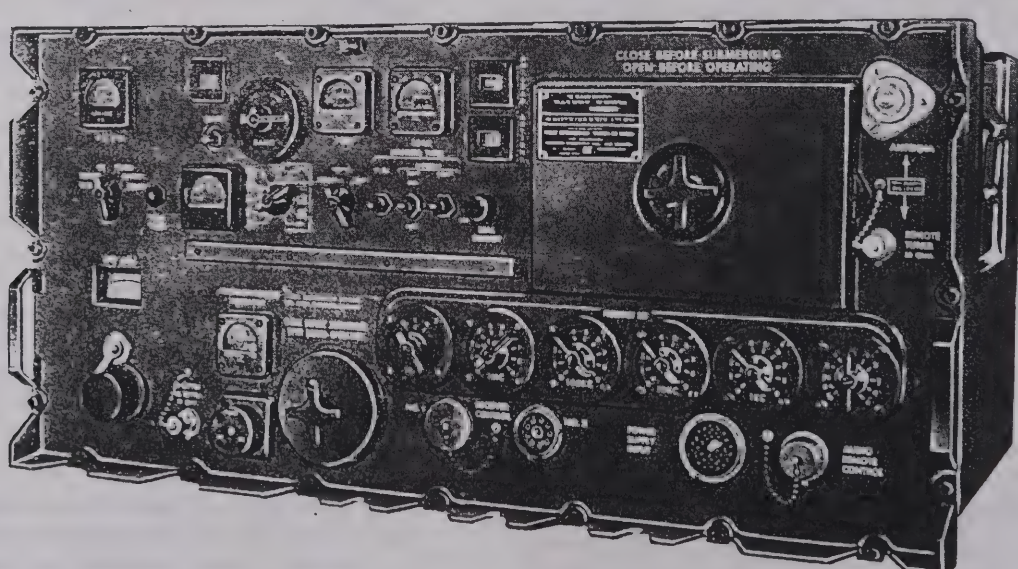


Figure 1–2. Radio Transmitter T–631/GRC–14, Front Oblique View

(2) AUDIO-FREQUENCY AMPLIFIER. — The af amplifier, a plug-in subassembly of the radio transmitter, receives phone input from the microphone or hand sets. During RELAY operation of the radio set, the received signals from the receiver are applied to the af amplifier. It contains circuitry necessary to amplify the audio voltages required to drive the modulator tubes in the amplifier-modulator, and to generate a sidetone signal during cw operation. The latter feature permits the equipment operator to monitor transmissions aurally.

The af amplifier is approximately 7 inches wide by 5-1/2 inches high by 3-1/2 inches deep, and is located on the top front center of the transmitter main chassis. Two captive screws secure the subassembly to the main chassis, and screw-mounted shield covers are provided for the top and both sides. A terminal board within the subassembly contains printed wiring on one side and associated component parts on the other. A shelf bracket contains three electron tubes, relay, transformers, capacitors, and a variable potentiometer.

(3) AMPLIFIER-MODULATOR. — The amplifier-modulator, a removable subassembly of the radio transmitter, is located on the top left of the transmitter main chassis, and is secured by six screws. It contains an input from the af amplifier to the push-pull modulator output stage for voice modulation of the rf carrier, an rf input from the vfo for power amplification, a control voltage from the servo control and a cw keying input from the keyer group. Output of the amplifier-modulator is applied to the rf tuner.

The tuning elements of the two-stage amplifier employ fixed capacitors which are ganged to permit selection by a single bandswitch, and variable inductors which are controlled by a single motor. Each variable inductor consists of the length of silver ribbon which is wound partly on a coil form and partly on a shorting drum. To change inductance, this ribbon is wound from the coil form onto the drum, and vice versa. The coil form and drum are driven synchronously by a motor and gear train for automatic tuning.

The amplifier-modulator is approximately 13 inches wide by 7 inches high by 15-3/4 inches deep. Variable inductors, a bandswitch, electron tubes, and transformers are mounted on top of the chassis; component parts, consisting of a blower assembly for cooling the modulator and power amplifier tubes, a shielded phase detector assembly, and a printed wiring board, are located on the underside.

(4) KEYER GROUP. — The keyer group, a plug-in subassembly of the radio transmitter, is located in the bottom right portion of the transmitter main chassis, between the mixer-stabilizer and the reference oscillator and mixer, where it is secured by two captive screws. It contains the relays and circuitry required to key the transmitter carrier on and off, and those required for automatic tuning of the transmitter. The relays are also used as components of the dynamotor control circuit. The keyer group also provides a dc voltage for use as microphone current supply.

The keyer group chassis is approximately 14-3/4 inches wide by 5-1/2 inches high by 2-1/2 inches deep. Relays and electron tubes are mounted on the outside, on top of the chassis, and component parts are located inside. Two shield covers are screw-mounted to both sides. Two panel-mounted connectors on the bottom of the chassis contain all electrical connections to the main chassis.

(5) SERVO CONTROL. — The servo control is a plug-in subassembly used for automatic operation of the transmitter. It is located in the bottom right rear corner of the transmitter chassis, where it is secured by two captive screws.

This assembly contains two similar servo amplifiers which act under control of sensing voltages to operate the motors that tune to resonance the tank circuits in the amplifier-modulator and the rf tuner. One servo amplifier controls the coil tuning motor in the rf tuner, while the other controls the capacitor tuning motor in the rf tuner and the coil tuning motor in the amplifier-modulator.

The servo control chassis measures approximately 15 inches wide by 6 inches high by 2-1/2 inches deep. The relays and electron tubes are mounted on top of the chassis; the other component parts and a printed wiring board are located on the inside. Two shield covers are screw-mounted on the subassembly, one on each side, and two panel-mounted connectors on the bottom of the chassis provide for all electrical connections to the main chassis.

(6) RADIO-FREQUENCY TUNER. — The rf tuner, a removable subassembly of the radio transmitter, is located on the top right of the transmitter main chassis and is secured by six mounting screws.

It is an impedance-matching device for matching the high input impedance of the antenna to the lower output impedance of the power amplifier stage in the amplifier-modulator. The rf tuner must be bypassed when the antenna input presents a low impedance such as that of a 50-ohm coaxial line or other low-impedance transmission line. Refer to paragraph 3–18*a* for the procedure for bypassing the rf tuner. The rf tuner contains two motor-driven variable elements, a resonating capacitor and a loading coil which is adjusted by the servo control. Impedance matching is achieved by simultaneous adjustment of both the inductive and capacitive elements. For automatic tuning, a phase detector circuit is used to sense the resonance of the circuits and the magnitude of the resulting impedance. The variable inductor is similar to that used in the amplifier-modulator described in paragraph 1–3*a* (3).

The rf tuner, a rectangular open-top chassis, is approximately 14 inches wide by 5-1/4 inches high by 10-3/4 inches deep. The phase detector assembly, rf connector, and cable harness are mounted on the right side of the chassis and the tuning mechanism

gear trains are located on the front, all outside the chassis. The two drive motors, the variable capacitor, and the inductor with its shorting drum are located on the inside.

b. POWER SUPPLY PP-1711/GRC-14. — The power supply (figure 1–3) is housed in a watertight cabinet (power supply cover). It is mounted in the vehicle below the radio receivers and radio transmitter. Overall dimensions of the power supply are approximately 29 inches wide by 10 inches high by 17-1/2 inches deep. Ventilating louvers in the cabinet have covers which may be closed to make the unit submersion-proof. The power supply chassis contains the dynamotor, voltage regulators, rectifiers, control circuits and fuses. The power supply furnishes the power required for operation of the major units of Radio Set AN/MRC–55, with facilities for front panel connection of input and output power. In addition, it proprovides power necessary for operation of teletype equipment.

It may be operated either from the 27.5-volt dc and 24-volt rms vehicular generating system, or from an external 115-volt ac source. The 24-volt supply is required only for teletype operation. The transfer is made by means of a three-position switch located on the front panel of the power supply.

When the power supply is operating from the dc output of the vehicular generating system, the following voltages are supplied to the major units:

+1100 volts dc
+312 volts dc
+250 volts dc, regulated
—105 volts dc
+26.5 volts dc, supply to receivers (vehicular operation only)
+26.5 volts dc, control voltage
+115 volts dc, for teletype equipment

When the power supply is operated from an external 115-volt, 60-cycle, ac source, the input voltage is stepped down, rectified, and fed to the dynamotor to provide the same output voltages as are obtained when operating from the vehicular dc power system, except that 115-volt, 60-cycle, ac is supplied to the receiver instead of +26.5-volt dc.

c. RADIO RECEIVER R–808/GRC–14. — Two identical superheterodyne radio receivers with a frequency range of 2 to 32 mc (in four bands) are supplied. (See figure 1–4.) They may be operated as a part of the overall radio set, or individually. Each is capable of receiving cw, modulated cw, phone, and fsk signals. An fsk converter is incorporated for directly keying a teletype loop circuit.

The radio receivers are mounted at the top left of the power supply. Overall dimensions of the radio receiver are approximately 10 inches wide by 13-3/4 inches high by 15-3/4 inches deep. It consists of a watertight cabinet (radio receiver cover) and the main chassis containing the following removable subassemblies:

Radio-Frequency Head
Intermediate-Frequency Amplifier
Amplifier-Power Supply
Frequency-Shift Converter

All indicators, controls and connectors are mounted on the front panel of the radio receiver.

(1) RADIO-FREQUENCY HEAD.—The rf head, a removable subassembly of the radio receiver, is located in the right center of the receiver main chassis, and is mounted on brackets by means of four screws.

It uses two stages of rf amplification. A local oscillator, in conjunction with a tuned harmonic amplifier, is employed to generate an if. frequency for reception of the 2 to 8-mc range. Double conversion with a crystal-controlled converter is utilized in the frequency range above 8 mc. An input from a crystal oscillator in the amplifier-power supply is employed to permit

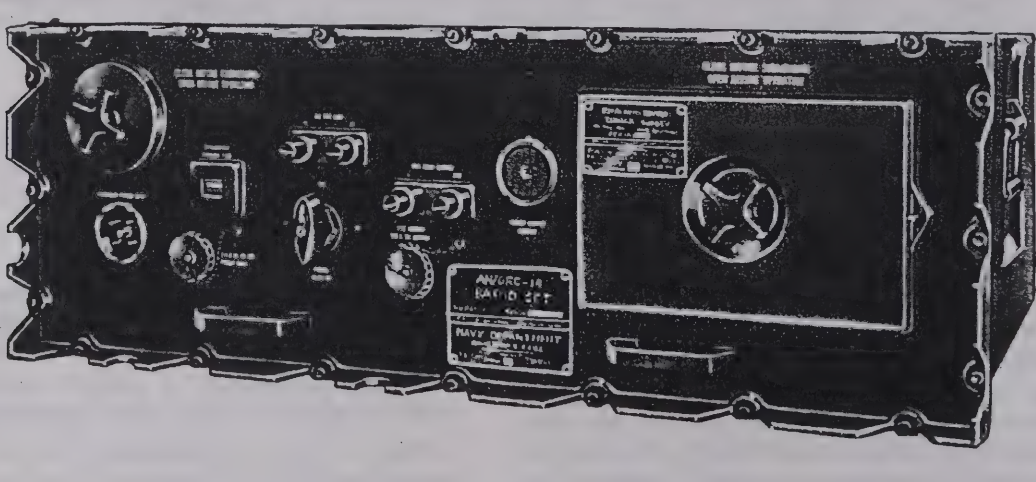


Figure 1–3. Power Supply PP–1711/GRC–14, Front Oblique View

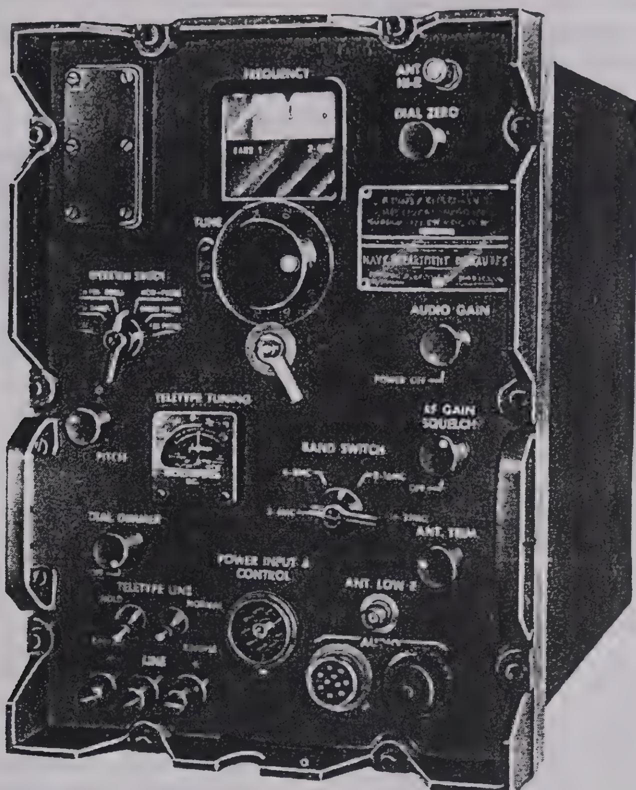


Figure 1-4. Radio Receiver R-808/GRC-14, Front Oblique View

dial calibration at an accuracy of better than 0.05 percent.

Overall dimensions for the rf head are approximately 14-1/4 inches wide by 8-1/2 inches high by 4-3/4 inches deep. Component parts are located inside the chassis with partitions and side covers employed for shielding. The five-section main tuning capacitor is located in a separate compartment, made accessible by removing the screw-mounted side covers. Electron tubes and adjustments for the variable if. and rf transformers are located on the outside, on the top and bottom of the subassembly. Coupling between the receiver front panel controls and the rf head subassembly is achieved by means of flexible couplers and arm assemblies.

(2) INTERMEDIATE-FREQUENCY AMPLIFIER. — The if. amplifier, a plug-in subassembly of the radio receiver, is located in the bottom left corner of the receiver main chassis, and is mounted by means of two captive screws.

The 455-kc signal entering the if. amplifier from the rf head is amplified and converted to an audio signal. Because of a low stage-by-stage gain, four stages of if. amplification are employed. The audio signal output is applied to the input stage of the amplifier-power supply. An output signal is taken off the third if. amplifier for application to the frequency-shift converter. A separate automatic gain control stage is employed to provide an agc voltage. Output from a beat frequency oscillator is applied to the detector stage when the radio receiver is operating on cw.

Overall dimensions of the if. amplifier are approximately 13-1/2 inches wide by 6 inches high by 1-1/4 inches deep. The chassis is rectangular in shape with electron tubes and if. transformers mounted on the outside. Component parts and a printed wiring board are located on the inside, and are shielded by a screw-mounted side cover. Detachable couplings are employed to connect the shafts of the variable components to the receiver front panel controls.

(3) AMPLIFIER-POWER SUPPLY. — The amplifier-power supply, a plug-in subassembly of the radio receiver, is secured by means of screws to the top of the receiver main chassis. It contains the receiver power supply, audio frequency amplifier circuits, and a crystal oscillator used to calibrate the main tuning dial.

The af signal from the if. amplifier is amplified in the audio frequency amplifier circuits and is available at the receiver front panel receptacles for handset,

earphone and loudspeaker use in all modes of operation except fsk. The audio signal is also used by the transmitter as a modulating voltage during RELAY operation. An adjustable squelch circuit for am. operation is used to maintain quiet operation of the radio receiver. A noise limiting circuit is used to limit impulse type interference such as atmospheric and ignition noise.

Input power to the power supply portion of the amplifier-power supply is controlled by a switch located on the front panel of Power Supply PP–1711/GRC–14. This power supply provides filament power and plate voltage to all subassemblies of the radio receiver.

When the vehicular generating system is being used as the source of input power, only the transistorized voltage regulator portion of the power supply is used. The vehicular 26.5 volts dc is then applied directly to the voltage regulator, and the voltage regulator output of +21 volts dc is distributed throughout the radio receiver. An additional output of +26.5 volts dc, unregulated, is supplied for use in the receiver.

When an external 115-volt, 60-cycle, ac source is used for input power, it is applied directly to the rectifier portion of the power supply. The stepped-down output of the rectifier, after filtering, is then divided with one part being applied to the voltage regulator circuit to provide a +21-volt dc output, and the other part (+26.5 volts, unregulated) being fed directly to the output of the amplifier-power supply for distribution within the receiver.

(4) FREQUENCY-SHIFT CONVERTER. — The fs converter, a plug-in subassembly of the radio receiver, is located in the bottom center of the receiver main chassis, between the if. amplifier and the rf head, and is mounted by two captive screws.

Two different types of frequency shift converter are supplied as part of the receiver. Radio Receivers R–808/GRC–14 having serial numbers 1 through 115, inclusive, use an af-type discriminator, whereas the remaining receivers use an if.-type discriminator. Both types are mechanically similar and can be physically interchanged.

The frequency-shifted signals from the if. amplifier are fed to the fs converter to obtain discrimination between the mark and space signals in order to operate an fsk keying relay. This relay, which is part of the fs converter is used to operate the teletypewriter selector magnet.

Overall dimensions of the fs converter subassembly are approximately 13-1/2 inches wide by 6 inches high by 1-7/8 inches deep. The unit is rectangular in shape, and has its electron tubes and larger components mounted on the outside. Component parts and a printed wiring board are located on the inside and shielded by a screw-mounted side cover.

d. RADIO SET CONTROL GROUP OA–1444/GRC–14. — Radio Set Control Group OA–1444/GRC–14 (figure 1–5) consists of Radio Set Control C–2171/GRC–14 (local remote control) and Radio Set Control C–2172/GRC–14 (field remote control).

The control group provides keying, talking and listening facilities for Radio Set AN/MRC–55 to a remote point (up to one mile) by means of a telephone line. It also provides ringing and telephone communication between local remote control and field remote control. Another function is the extension of power control (dynamotor) of the radio set to the field remote control unit.

(1) RADIO SET CONTROL C–2171/GRC–14. — Local remote control provides a local terminal in the vehicle for field remote control, in addition to push-to-talk control of the radio transmitter from a remote point in the vehicle.

The interphone circuit between the local and field remote control units consists of line transformers joined by telephone lines, with dry cells installed, and with microphones and phones connected to their respective windings. Ringing is achieved by cranking a hand ringer which operates a bell or call light under control of a switch within the units.

Control and mode of operation of the transmitter are determined by two switches on the front panel (SERVICE and OPERATION). In LOCAL; AM operation, the dynamotor is placed under control of the push-to-talk switch of the microphone or handset.

The local remote control is a compact, lightweight, watertight unit, rectangular in shape, with overall dimensions of approximately 8-3/4 inches wide by 3-1/2 inches high by 10-1/2 inches deep. It may be removed from its case by loosening the two captive thumb screws on the front panel. The submersion-proof front panel contains the control, indicator, ringer, and line terminals.

The local remote control contains three plug-in relays for the control circuit which are necessary for AM, CW/FSK operation from the field remote control. A five-wire cable assembly is used for connecting local remote control to the transmitter front panel.

(2) RADIO SET CONTROL C–2172/GRC–14. — Field remote control provides means for controlling the radio set in am. and cw keying operation over a two-wire telephone line (600 ohms) up to one mile in length. Telephone operation with ringing facilities between the remote control units is also provided. When a teletypewriter set is to be used with the radio set from a remote position, the teletype circuit is connected directly to the radio set in the vehicle and the field remote control is used to turn the dynamotor on and off.

Control of the dynamotor is accomplished by a control circuit consisting of a SERVICE selector switch, a 45-volt dc control voltage supplied by a battery in field

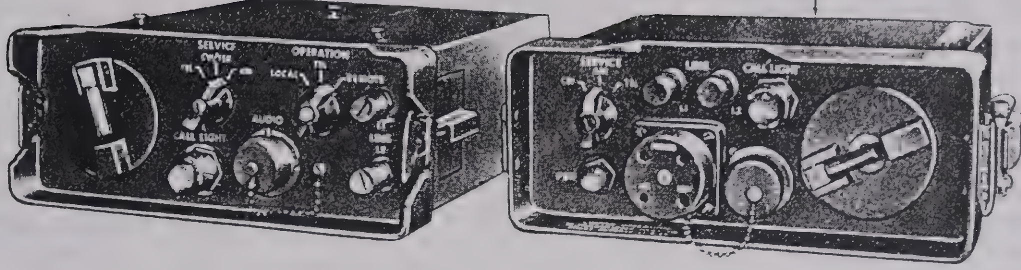


Figure 1-5. Radio Set Control Group OA-1444/GRC-14, Front Oblique View

remote control, and control relays located in local remote control. The circuit is completed by the push-to-talk switch in am. operation, and "key down" or FSK control (on the front panel of the field remote control) in cw keying or fsk teletype operation.

The interphone circuit of field remote control is similar to that of local remote control.

The field remote control is similar in size and appearance to the local remote control. Overall dimensions are approximately 9-1/2 inches wide by 3-1/2 inches high by 7-1/4 inches deep. It may be removed from its watertight case by loosening the snap fasteners at each side. The submersion-proof front panel contains all controls and terminals required for the operation of the field remote control. Provisions have been made for connecting two headsets, a microphone, and a key, in addition to Handset H-33(E)/PT. A carrying strap is provided to facilitate carrying the unit.

e. GENERATOR INSTALLATION KIT MK-366/MRC-55. — The generator system, supplied in kit form, replaces the original 28-volt dc, 25-amp vehicular generating system. It is a heavy duty, 28-volt, 100-amp, rectified ac electrical generating system that includes an alternator (generator), rectifier, regulator assembly, and interconnecting cables.

The alternator is driven by four belts from the engine output shaft, and delivers three-phase, low-voltage energy to the selenium rectifier unit. Voltage from the rectifier is used to charge the vehicle batteries under control of the voltage regulator, and to supply other loads required from the 28-volt dc power system. Full charging rates are obtained at relatively low engine speeds.

f. ANTENNA SET. — The antennas to be used with Radio Set AN/MRC-55 consist of two long-wire antennas for use with a fixed installation, and two whip antennas for vehicular use. Both whip antennas measure 15 feet in length, with either whip antenna extendable to 30 feet for semi-fixed station operation from the vehicle. The whip antennas are mounted by means of mast brackets, in the rear of the vehicle at the port and starboard sides.

Refer to table 3-2 for the list of items comprising the antenna set.

g. ELECTRONIC EQUIPMENT INSTALLATION KIT MK-371/MRC-55 AND MOUNTING BASES.— The installation material consists of the following items necessary for the installation of Radio Set AN/MRC-55 in Ordnance Vehicle M38-A1.

Mounting MT-1832/U (Power Supply)
Mounting MT-1833/U (Transmitter-Receiver)
Mounting MT-1834/U (Accessories Cabinet)
Mast Base MP-57 (2 used)
Insulator Brackets (2 used)
Hardware (all installation hardware, except vehicular generator system hardware)

h. ACCESSORY KIT MK-377/GRC-14.— The accessory kit consists of the following:

Accessory Cabinet CY-2134/GRC-14.
Accessories
Interconnecting Cables

The accessory cabinet is used to store the accessories used with the radio set. The interconnecting cables are used to interconnect the major units of the radio set. The accessories supplied with the radio set consist of the following items. Note that H2901 through H2906, and E2901 and E2902 are located in tool bag A2901.

Headset, type NT–49507
Headset extension cord, type CX–1334/U
Handset, type H–33(E)/PT
Hand microphone, type T–17
Dynamic loudspeaker, type LS–166/U
Telegraph key, type NT–26026
Telegraph key, leg-band type NT–10531
Wrench, hex-head, #4 (H2901)
Wrench, hex-head, #6 (H2902)
Wrench, hex-head, #8 (H2903)
Wrench, hex-head, 1/4 inch (H2904)
Wrench, hex-head, 7/16 inch (H2905)
Wrench, hex-head, 3/8 inch (H2906)
Wrench, hex-head, #10–12 (H2907)
Aligner, core (E2901)
Aligner "J" tran (E2902)
Tool bag (A2901)

1–4. REFERENCE DATA.

a. Nomenclature.— Radio Set AN/MRC–55

b. Contract Data. — NObsr–71017

c. Contractor. — Federal Telephone and Radio Company, Clifton, New Jersey

d. Cognizant Naval Inspector. — Inspector of Naval Material, Newark, New Jersey

e. Frequency Range. —
Transmitter: 2 to 30 mc, in 100-cps steps
Receiver: 2 to 32 mc, continuous

f. Tuning Bands. —
Transmitter: Band 1: 2 to 3 mc
Band 2: 3 to 6 mc
Band 3: 6 to 10 mc
Band 4: 10 to 20 mc
Receiver: Band 1: 2 to 4 mc
Band 2: 4 to 8 mc
Band 3: 8 to 16 mc
Band 4: 16 to 32 mc

g. Type of Frequency Control. — Variable frequency oscillator
Crystal reference oscillator
Frequency shift oscillator

h. Types of Emission and Modulation Capability. — A1 (cw)
A3 (phone) 100%
F1 (fsk) ±150 cps to ±500 cps

i. Nominal Carrier Output (into a 50-ohm load). —
A1: 100 watts
A3: 100 watts
F1: 100 watts

j. Peak Power Output. — 400 watts (A3, 100% modulation)

k. Type Receiver. — Superheterodyne (double conversion on bands 3 and 4)

l. Intermediate Frequency. — 455 kc and 1500 kc

m. Intermediate Frequency Selectivity.—
Sharp: Total bandwith at 6 db points 3.5 ± 0.5 kc
Broad: Total bandwith at 6 db points 7 ± 1 kc

n. Receiver Frequency Range of Local Oscillator. —
Bands 1 and 2: 2.18 to 4.50 mc
Bands 3 and 4: 8.65 to 17.90 mc

o. Type of Reception. — A1, A2, A3, and F1

p. Crystals, Quartz:
Transmitter: 28 crystals
Receiver: 3 crystals

q. Frequency Accuracy. —
Transmitter: ±200 cps after one hour warm-up
Receiver: ±0.05% (between calibration points)

r. Receiver Squelch Circuit. — Cuts off the audio amplifier in the absence of an rf input signal. (Turns on transmitter when using RELAY operation.)

s. Input and Output Impedances. —
Transmitter Input: 100 ohms (microphone)
600 ohms (for line from field remote control)
Transmitter Outputs: High impedance (to match 15 or 30-foot whip, or long-wire antenna)
50 ohms (with rf tuner by-passed)
Receiver Input: 300 ohms (HI–Z); 50 ohms (LOW–Z)
Receiver Output: 600 ohms

t. Response Characteristics. —

Transmitter Audio Frequency: ±3 db of 1000-cycle response over range of 300 to 3500 cycles. The audio frequency response is down 30 db minimum at all frequencies below 100 cycles.

Receiver Audio Frequency (Sharp): Bandwith 350 cps at ±6 db

Receiver Audio Frequency (Broad): Variation in response, between 300 and 3000 cps, does not exceed ±3 db relative to 1000 cps

u. Antenna Characteristics. — Antenna tuning equipment is capable of tuning into a 15 to 30-foot whip antenna, or into a long-wire antenna. Automatic transfer between transmitter and receiver in any operation.

v. Power Supply Characteristics. —

Operating Power Requirements: +26.5-volt dc and 24-volt, 60 to 600-cps ac (24-volt ac required only for teletype operation)
or
115-volt, 60-cps ac

Output voltages (dc):
+1100 volts
+250 volts, regulated
+312 volts
—105 volts
+26.5 volts
+115 volts, filtered
+115 volts, unfiltered

TABLE 1-1. EQUIPMENT SUPPLIED

QUANTITY PER EQUIPMENT	NAME OF UNIT	DESIGNATION	OVERALL DIMENSIONS*			VOLUME*	WEIGHT*
			HEIGHT	WIDTH	DEPTH		
1	Transmitter, Radio	T-631/GRC-14	13-3/4	29	17-1/2	4.04	157
1	Power Supply	PP-1711/GRC-14	10	29	17-1/2	2.94	284
2	Receiver, Radio	R-808/GRC-14	13-3/4	10	17-1/2	1.39	71
1	Control, Radio Set	C-2171/GRC-14	3-3/4	10-3/8	8-7/8	0.2	8
1	Control, Radio Set	C-2172/GRC-14	3-11/16	9-3/8	7-1/8	0.14	7
1 set	Installation Kit, Electronic Equipment	MK-371/MRC-55					
1 set	Installation Kit, Generator	MK-366/MRC-55					91
1 set	Accessory Kit, Cabinet, Accessory	MK-377/GRC-14 CY-2134/GRC-14	9-1/4	7-5/8	11-9/16	0.47	15
1	Mounting	MT-1832/U	1-3/4	14-3/4	4	0.06	7
1	Mounting	MT-1833/U	3-1/2	50	16-3/8	1.66	59
1	Mounting	MT-1834/U	1-5/16	10-3/4	8-1/8	0.07	1
1 set	Antenna Set						22
2	Technical Manual	NAVSHIPS 92911(A)					3

*Dimensions are in inches, volume in cubic feet, and weight in pounds.

TABLE 1–2. EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED

QUANTITY PER EQUIPMENT	NAME OF UNIT	DESIGNATION	REQUIRED USE	REQUIRED CHARACTERISTICS
1	1/4-Ton, 4 x 4 Ordnance Vehicle	M38–A1	Equipment portage	With deep-water fording kit
1 set	Teletypewriter Set	AN/TGC–6	Teletype transmission and reception	With Teletypewriter TT–4/TG
1	Technical Manual, Teletypewriter TT–4/TG	TM 11–2234 (TO 16–35TT 4–5)	Instructions	
1	Handbook of Test Methods and Practices	NAVSHIPS 91828(A)	Instructions for corrective maintenance	
	Test Equipment	(See table 7–1.)	(See section 7.)	(See table 7–1.)

TABLE 1–3. SHIPPING DATA

SHIPPING BOX NO.	CONTENTS		OVERALL DIMENSIONS*			VOLUME*	WEIGHT*
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
1	Transmitter, Radio	T–631/GRC–14	39	24	23	12.5	230
2	Power Supply	PP–1711/GRC–14	39	24	16	8.7	310
3	Receiver, Radio (No. 1)	R–808/GRC–14	22	17	22	4.8	105
4	Receiver, Radio (No. 2)	R–808/GRC–14	22	17	22	4.8	105
5	Control, Radio Set Control, Radio Set	C–2171/GRC–14 C–2172/GRC–14	12	12	12	1.0	18
6	Mounting Mounting Mounting Desk, Radio Equipment	MT–1832/U MT–1833/U MT–1834/U	52	20	7	4.2	102
7	Accessory Kit Cabinet, Accessory Accessories Interconnecting Cables (7) Antenna Set Insulator Brackets (2) Mast Base (2) Hardware Technical Manual (2)	MK–377/GRC–14 CY–2134/GRC–14 MP–57 NAVSHIPS 92911(A)	46	20	14	7.6	130
8	Installation Kit, Generator	MK–366/MRC–55	22	18	16	3.6	112
9	Equipment Spares		39	24	16	8.7	122

*Dimensions are in inches, volume in cubic feet, and weight in pounds.

TABLE 1-4. GENERAL NOMENCLATURE

OFFICIAL NOMENCLATURE	COMMON NAME	REFERENCE SYMBOL GROUP
Transmitter, Radio T-631/GRC-14	Radio transmitter	
	Main chassis	1301-1399
	Variable frequency oscillator (vfo)	101-299
	Reference oscillator and mixer	401-599
	Mixer-stabilizer	701-799
	Keyer group	801-899
	Rf tuner	1201-1299
	Amplifier-modulator	1001-1099
	Af amplifier	1101-1199
	Servo control	901-999
	Transmitter cover	
Power Supply PP-1711/GRC-14	Power supply	1401-1499
	Power supply cover	
Receiver, Radio R-808/GRC-14	Radio receiver	
	Main chassis	1501-1599
	Rf head	1501-1599
	Amplifier-power supply	1501-1599
	If. amplifier	1601-1699
	Fs converter	1701-1799
	Receiver cover	
Control Group, Radio Set OA-1444/GRC-14	Control group	
Control, Radio Set C-2171/GRC-14	Local remote control (with mounting)	1901-1999
Control, Radio Set C-2172/GRC-14	Field remote control (with mounting)	2001-2099
	Antenna set	3001-3099
Installation Kit, Electronic Equipment MK-371/MRC-55	Installation kit insulator brackets hardware	3101-3199
Mounting MT-1832/U	Power supply mounting	2401-2499
Mounting MT-1833/U	Transmitter-receiver mounting	2301-2399
Mounting MT-1834/U	Accessories cabinet mounting	2601-2699
Installation Kit, Generator MK-366/MRC-55	Generator system	2200-2299
Accessory Kit MK-377/GRC-14	Accessory kit	
Cabinet, Accessory CY-2134/GRC-14	Accessories cabinet	2801-2899
	Accessories interconnecting cables	2100-2199

TABLE 1–5. RADIO SET AN/MRC–55, ELECTRON TUBE, TRANSISTOR AND DIODE COMPLEMENT*

UNIT	TYPES																													
	ZA-8	1N69	1N251	1N540	1N645	2N117	2N174	2N340	2N539	4JA11DC1AD1	4JA60A	4JA411BC1ADZ	4X250F	6AH6	6AJ5	6CL6	12AT7WA	12BA6	26A6	5651	5654/6AK5W	5687WA	5725/6AS6W	5750/6BE6W	5751	5751WA	5814A	6005/6AQ5W	6082	TOTAL
Transmitter, Radio T631/ GRC–14																														
Variable Frequency Oscillator					3																	1					1			5
Reference Oscillator and Mixer																	1				4		1	1						7
Mixer-Stabilizer		2												6																8
Keyer Group					3																							2		5
RF Tuner		4																												4
Servo Control																	2					1			2					5
Amplifier-Modulator		5		4									3			1														13
AF Amplifier																	2	1												3
Power Supply PP–1711/ GRC–14										1	2									1						1			2	7
Receiver, Radio R–808/GRC–14																														
Main Chassis							4		2																					6
RF Head															10		2							2						14
Amplifier-Power Supply	2	4				2		4				2			8		4													26
IF Amplifier															10		2													12
FS Converter note 1 / note 2			/ 4		10 /			4 / 4											8 / 6											22 / 14
Total Number of Each Type note 1 / note 2	2	15	/ 4	4	16 / 6	2	4	8 / 8	2	1	2	2	3	6	28	1	13	1	8 / 6	1	4	2	1	3	2	1	1	2	2	137 / 129

*Includes both receivers.
Note 1. Quantities are for radio sets having receivers with serial numbers 1 through 115 inclusive.
Note 2. Quantities are for radio sets having receivers with serial numbers 116 and following.

TABLE 1-6. RADIO SET AN/MRC-55 CRYSTAL COMPLEMENT

SYMBOL	OSCILLATING FREQUENCY	SYMBOL	OSCILLATING FREQUENCY
RADIO TRANSMITTER T-631/GRC-14			
Y401	3.7 mc	Y415	12 mc
Y402	3.8 mc	Y416	13 mc
Y403	3.9 mc	Y417	14 mc
Y404	4.0 mc	Y418	15 mc
Y405	4.1 mc	Y419	16 mc
Y406	4.2 mc	Y420	17 mc
Y407	4.3 mc	Y421	18 mc
Y408	4.4 mc	Y422	17 mc
Y409	4.5 mc	Y423	16.5 mc
Y410	4.6 mc	Y424	16 mc
Y411	8 mc	Y425	18 mc
Y412	9 mc	Y426	17.5 mc
Y413	10 mc	Y427	11.666666 mc
Y414	11 mc	Y428	13.333333 mc
RADIO RECEIVER R-808/GRC-14			
Y1501	200.000 kc		
Y1502	1955.000 kc		
Y1701	452.500 kc		

time that S1203 opens, microswitch S1205 (auto tune start rf tuner coil) will close. These two microswitches are in series with K803 (rfa tune relay). Consequently, the rfa will start to tune only when both B1002 and B1202 are at their home positions. Relay K803 is energized from the 26.5-volt control bus through S1004, S1005 and normally closed contacts 8 and 17 of relay K804 to ground through S1302, section 1, front. Contacts 20 and 1 of K803 close, bypassing S1004 and S1205, causing 26.5 volts to be applied through the K803 contacts to the coil of K803. Contacts 15 and 5 of K803 close, which energize K801 (dynamotor auxiliary control relay) through contacts 3 and 4 of K1402. Contacts 20 and 1 of K801 close to energize K1403 (dynamotor control relay) which applies power to the dynamotor. Contacts 10 and 19 of K803 open, causing K802 to de-energize. Contacts 3 and 13 and 5 and 15 of K802 open, removing the servo amplifier bypass circuit from motors B1002 and B1201. Contacts 7 and 16 of K803 close, causing +250-volt dc (regulated) to be applied to the plates of servo control tubes V901, V902, V903, V904, and V905. Contacts 2 and 13 of K803 open, removing thermal time delay relay K806 from the 26.5-volt control bus. Contacts 3 and 13 of K803 close, placing the thermal relay heating element in series with contact 11 of K805. (Although the 26.5 volts from the control bus is removed from K806, the relay will not de-energize, due to thermal lag and the fact that it receives power from another source almost immediately, as will be shown in the next paragraph.) Contacts 9 and 17 of K803 close, applying power via contacts 2 and 13 of K804 to light. Second thermal time delay relay K807. Closed contacts 9 and 17 also energize K805 (servo transfer relay.)

Contacts 20 and 12 of K805 open to isolate B1202 completely from the 26.5-volt control bus. (This is done to interlock motor B1202. It is possible that K903 may energize during the rfa tuning cycle due to residual circuit effects.) Contacts 13 and 3 of K805 close, grounding the grid of keying delay tube V802 through energized contacts 11 and 19 of K803 and S1302, section 1, front, causing it to conduct. As a result, antenna transfer relay K1301 energizes, and removes bias from the grid of vfo tube V101, causing the vfo to become operative. Contacts 5 and 15 of K805 close, causing the output of the rfa phase detector to be connected to the input of the tune servo amplifier. Contacts 19 and 11 of K805 close, placing contact 4 of K906 in series with the forward winding of B1002 through S1003 and also keeping the heater element of time delay relay K806 energized. Contacts 17 and 9 of K805 close, placing contact 7 of K906 (servo control) in series with the reverse winding of B1002 through R805 and S1005. Conduction of servo amplifier tube V904 will cause K906 (tune servo relay) to close contacts 6 and 4 or 6 and 7 in accordance with the polarity of the input voltage. Consequently, 26.5 volts from the control bus will be applied to either the forward or reverse winding of B1002 through K906 and contacts 19 and 11, and 17 and 9 of K805. Motor B1002 must initially move forward from its home position. Therefore, thermal time delay relay K806 has power applied to it through contacts 11 and 19 of K805, and 4 and 6 of K906 to the 26.5-volt control bus while the motor is tuning forward. Actually, the relay remains actuated until the rfa coil becomes resonated. Upon reaching the resonant point K906 becomes de-energized, removing power to B1002, and causing it to stop turning.

Approximately four to ten seconds after motor B1002 has made its last forward movement and contact 6 of K906 returns to its center position, thermal relay K806 will de-activate and its open contacts 3, 4, and 8, 9 will return to their normally closed positions. This will cause K804 rf tuner tune relay to be energized from the 26.5-volt control bus through the actuated contacts 3, 4 and 8, 9 of K807 to ground through closed contacts 3, 4 and 8, 9 of K806 and S1302, section 1, front. Contacts 17 and 8 of K804 open, causing K803 to de-energize, which causes contacts 2 and 13 of K803 to close and again apply power to time delay relay K806. However, closed contacts 1 and 20 of K804 bypass the K806 contacts 3, 4, and 8, 9, and when they open, power will still be applied to the coil of K804 through contacts 1 and 20. Contacts 5 and 15 of K803 open, but contacts 5 and 15 of K804 close to keep K801 (dynamotor auxiliary control relay) energized. Contacts 19 and 10 of K804 open to prevent the automatic reset circuit from being accidentally energized while tuning is in process. Contacts 7 and 16 of K803 open, but +250 volts, regulated) is still applied to the plates of V901, V902, V903, V904, and V905 through closed contacts 7 and 16 of K804. Contacts 9 and 17 of K803 open, removing thermal time delay relay K807 from the 26.5-volt control bus. Contacts 3 and 13 of K804 close, placing the thermal relay heating element in series with contact 7 of K903 (servo control). (Although the 26.5 volts from the control bus is removed from K807, the relay will not de-activate because of thermal lag and the fact that it receives power from another source almost immediately, as explained in the next paragraph.)

Contacts 9 and 17 of K803 open and de-energize K805 (servo transfer relay). Contacts 2 and 13 of K805 close to ground the grid of keyer amplifier tube V801 through contacts 9 and 17 of K804 and S1302, section 1, front, causing it to conduct. This keys power amplifier tube V1002 to allow resonating the rf tuner. Contacts 15 and 5 open, and contacts 4 and 15 of K805 close, thereby transferring the input to tune servo amplifier V903 from the rfa to the rf tuner. Contacts 19 and 10 of K805 close, thereby transferring the output of servo amplifier V904 from B1002 (rfa coil control) to the forward winding of B1201 (rf tuner capacitor control). Conduction of servo amplifier tube V904 will cause K906 (tune servo relay) to energize and 26.5 volts from the control bus will be applied to the forward winding of B1201 through contacts 19 and 10 of K906. The 26.5 volts is also applied to thermal relay K807 through K906, CR802, and K804, contacts 3 and 13. Likewise, conduction of load servo

amplifier tube V902 will cause contacts 6 and 7 of K903 (load servo relay) to close. As a result, 26.5 volts from the control bus will be applied to the forward winding of B1202 through K903. The 26.5 volts is also applied to thermal relay K807 via K903, CR803, and K804. Diode CR802 or CR803 keeps voltage applied to K807 as long as either motor is tuning. The diodes also isolated the two motors from each other, thereby preventing either motor from being driven from the other's supply. The relay remains actuated until the rf tuner is resonated and properly matched to the antenna. Upon completion of the tuning, servo control relays K906 and K903 de-energize, removing power from the rf tuner motors and thermal relay K807.

Approximately four to ten seconds later, thermal relay K807 will cool and de-activate, causing its contacts (3, 4, and 8, 9) to return to their normally open positions. This will cause K804 to de-energize, the automatic control circuits will be disabled, and the transmitter will be ready for operation.

(1) FALSE SENSE RELAY K808. — The coil of relay K808 is connected in the grid circuit of power amplifier V1002. Current to energize the relay is only present when V1002 is near, or at, resonance because at other times V1002 will not be drawing grid current. When K808 is de-energized, —105 volts is applied to the tune servo amplifier (V903) input through normally closed contacts 3 and 4 of K808, and energized contacts 5 and 15 of K805. The —105 volts serves as a simulated control voltage to supply the necessary drive to V903 to energize B1002 and tune the rfa. When resonance is approached, V1002 draws grid current, causing K808 to energize, removing the —105-volt false sense signal from the tune servo amplifier, and allowing the output of the phase detector to assume control of B1002.

(2) FALSE SENSE SIGNAL SWITCH S1206. — At frequencies below 4.0 mc, the rf tuner will not be able to reach a tuning point in the usual way. (Refer to paragraph 2–2.) At such times, rf tuner capacitor C1201 will be at its maximum position. When C1201 is at maximum. microswitch S1206 is closed by motor B1201. This allows —105-volts dc to be applied to the rf tuner phase detector through current limiting resistor R804, closed contacts 16 and 6 of K805 and S1206. This will cause B1202 (rf tuner coil control) to tune the coil, with the result that capacitor C1201 will tune towards minimum to maintain resonance. When this occurs, the false sense signal is no longer required and microswitch S1206, which is closed only at the maximum capacitance position of B1201, will open, removing the false sense signal.

(3) MOTOR LIMIT SWITCHES. — Tuning motors B1002, B1201, and B1202 have limit switches S1003, S1005, S1201, S1202, S1203 and S1204 connected in series with their fields. These are microswitches mechanically connected to the motor shafts by a lead screw mechanism. When the variable components tuned by the motors reach their maximum or minimum positions, the applicable switches will open to remove power from the motors and prevent damage to the components or motors.

2–6. RADIO RECEIVER R–808/GRC–14.

a. OVERALL FUNCTIONAL DESCRIPTION. — Two radio receivers are supplied as components of Radio Set AN/MRC–55. They are identical in design, and are enclosed in watertight cabinets. One receiver may be employed as a standby while the other is operating, or both receivers can be operating at the same time. Signal inputs to the receiver are applied from either a high- or low-impedance antenna which is common to the transmitter, or an independent high- or low-impedance antenna.

The receiver is of the superheterodyne type operating in the frequency range of 2 to 32 mc, covered in the following four bands: 2 to 4 mc, 4 to 8 mc, 8 to 16 mc, and 16 to 32 mc. (The coverage of each band is somewhat greater than listed due to frequency overlap at the extreme ends of each band.) Reception facilities for cw (A1), mcw (A2), phone (A3), and fsk (F1) signals are provided. Provisions are made for simultaneous reception of fsk and phone transmissions on the same frequencies. The receiver is capable of keying a polar or neutral teletypewriter located at a remote site.

It differs from conventional equipments in the following respects: (1) The plate voltage supply for the electron tubes is only +21 volts dc regulated; (2) the frequency-shift converter required for teletypewriter reception is included in the receiver, rather than in accessory equipment; (3) transistors are used, where practical, to reduce heat dissipation.

To allow for two-way relay of communications, the receiver can turn the transmitter on and off automatically for retransmission of received signals when such a service is desired.

As shown in the block diagram, the receiver is conventional in most respects. (See figure 2–29.) The received signal passes through two stages of rf amplification and is then applied to the control grid of the mixer tube. Local injected frequency is obtained from a tunable oscillator followed by a harmonic amplifier. The oscillator is continuously tunable in two ranges of 2.18 to 4.50 mc and 8.65 to 17.75 mc. The harmonic amplifier selects the fundamental oscillator output frequencies for operation on bands 1 and 3 and second harmonies for operation on receiver bands 2 and 4.

When operating on bands 1 and 2 (2 to 8 mc), the difference frequency is applied directly to the input of the 455-kc if. strip. For bands 3 and 4 (8 to 32 mc), the difference frequency is 1500 kc, that must be further mixed in a converter stage to obtain a 455-kc beat signal which is then applied to the if. strip. Provision is also made in the receiver front end to inject a calibration signal at the first rf stage. This frequency is utilized to calibrate the receiver main tuning dial through the use of a movable fiducial pointer.

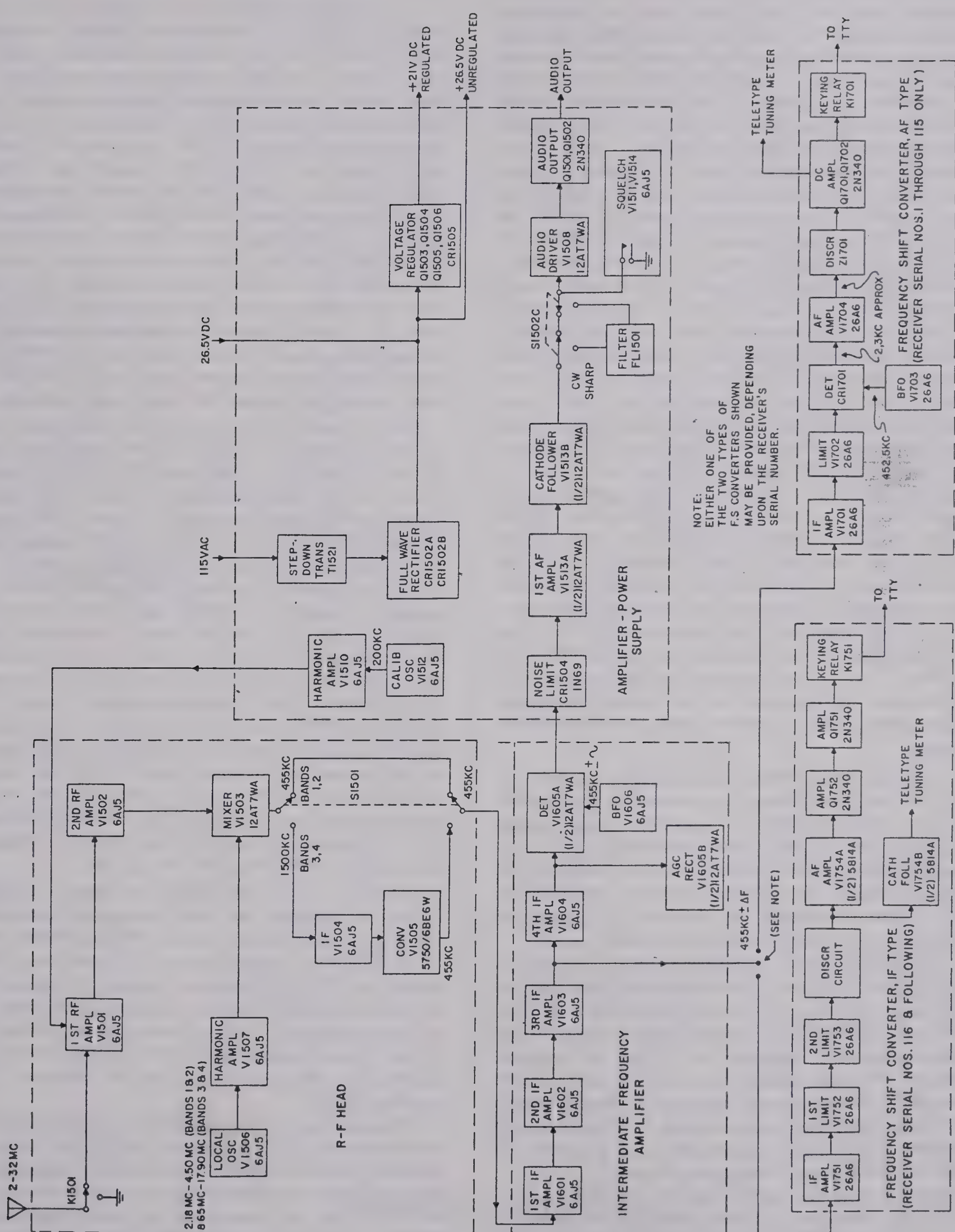


Figure 2-29. Radio Receiver, Block Diagram

The if. signal is then amplified and converted to audio frequencies in the if. strip. Four stages of amplification are necessary because of the low stage-by-stage gain, which is a result of the low value plate voltage. An output signal at the if. frequency is obtained from the third i-f amplifier for application to the frequency-shift converter subassembly. An automatic gain control voltage is developed in the detector stages for use in the rf amplifiers, and in the first three if. amplifiers. In addition, the output from a beat frequency oscillator (bfo) is applied to the detector when the receiver is operating on cw.

Audio frequency output from the detector is passed through a noise-limiter circuit, and then applied to the af amplifiers for all modes of operation except fsk. In the CW SHARP position of the OPERATION SWITCH, the amplifier output is passed through a bandpass filter which is bypassed in the other switch positions. The output of the second audio amplifier is fed to an audio driver stage from which it goes to a transistorized push-pull final amplification stage. Audio output is then available at front panel receptacles for handset, earphone and loudspeaker use. The af strip also incorporates a squelch circuit used during phone operation to quiet the receiver when there is no incoming signal, by disabling the audio section.

When using the receiver for fsk operation, the output from the third if. stage is applied to the frequency-shift converter. Either of two types of frequency-shift converter is used, depending upon the serial number of the R–808/GRC–14 receiver provided. Converters used in receivers having serial numbers 1 through 115 differ from later production models. The two types differ in circuits used, but provide the same function. That is, the frequency-shifted if. signal is demodulated and converted to a dc voltage to energize a keying relay used to operate a teletypewriter selector magnet.

b. RADIO-FREQUENCY HEAD. *(See figures 2–30 and 7–80.)* — The rf head is a removable plug-in subassembly whose function is to amplify rf input signals and convert them to the 455-kc intermediate frequency. Band 1 and band 2 operation use one heterodyning stage to produce the 455 kc. However, operation on bands 3 and 4 requires an additional conversion to obtain the 455-kc intermediate frequency.

(1) ANTENNA INPUT. — Incoming signals from either the high- or low-impedance antenna are applied to the input of the first rf amplifier through BAND SWITCH S1501. Switch S1501 sections 10 and 9 (low-impedance antenna) or 11 and 9 (high-impedance antenna) selects the correct coil (T1501 through T1504) for bands 1 through 4. The appropriate coil is connected across section 5 of main tuning capacitor C1501. The unused coils are grounded by S1501 to prevent any absorption effects.

Receiver break-in operation is accomplished by energizing disable relay K1504 whenever the transmitter is keyed (except for RELAY operation of the radio set). Relay K1504 is energized by providing a ground return for its coil, through E803 in the transmitter keyer group. This is done to prevent feedback and component damage to the received front end when the receiver and transmitter are tuned to the same frequency.

(2) RF AMPLIFIERS V1501 AND V1502 (6AJ5). *(See figure 2–31.)* — The input circuits of rf amplifiers V1501 and V1502 are tuned for resonance with sections 4 and 5 of main tuning capacitor C1501. The two rf stages are conventional amplifiers having tuned interstage coupling for each of the four bands. Variable air dielectric capacitor C1506 is connected across the first rf amplifier (V1501) input circuit and is varied by the front panel ANT TRIM control. This capacitor is an antenna trimmer, and is used to compensate for antenna characteristics at the various frequencies used. Neon lamp DS1501 is also connected across the input circuit for over-voltage protection. When the voltage across the tuned circuit rises to approximately 50 volts (due, for example, to tuning the receiver to the frequency of a nearby transmitter), the lamp will glow and effectively place a low impedance across the circuit, thereby protecting the components from damage.

The +21-volt dc plate supply for V1501 and V1502 is obtained from the amplifier-power supply subassembly, and is applied to V1501 and V1502 through section 8 and section 7, respectively, of S1501. For band 1 operation, the signal is coupled across T1501 applied to the control grid of V1501 for amplification, passed through section 8 of S1501 (terminals 11 and 12), and then placed on the primary winding of T1505. The secondary winding of T1505 and trimmer capacitor C1514 are pretuned for the band 1 frequency range. This filter section is further tuned by C1501, section 4. The signal is applied to the control grid of the second rf amplifier (V1502) through terminals 11 and 12, section 7, of S1501, and coupling capacitor C1510. It is amplified again in the second rf stage, and then applied to the control grid of mixer tube V1503. The gain of the second rf amplifier stage is adjusted by varying the cathode voltage with RF GAIN SQUELCH control R1531. The output coupling from V1502 is similar to the output circuit employed for V1501.

Facilities are provided within the receiver to supply a signal to calibrate the main tuning dial through the use of a movable fiducial pointer. When OPERATION SWITCH S1502 is placed in the CAL position, a 200-kc signal having a high harmonic content is applied from harmonic amplifier V1510 in the amplifier-power supply subassembly, to the suppressor grid and cathode of the first rf amplifier, V1501 through J1511, and follows the same path through the receiver as the received signals.

An agc voltage is applied (during phone operation) to the control grids of V1501 and V1502 from agc rectifier V1605B in the if. amplifier to compensate for fading in the transmitted signal. In addition, the gain of V1501 can be controlled by front panel control R1531, which is in the cathode circuit, and serves as a voltage divider across the regulated +21-volt supply.

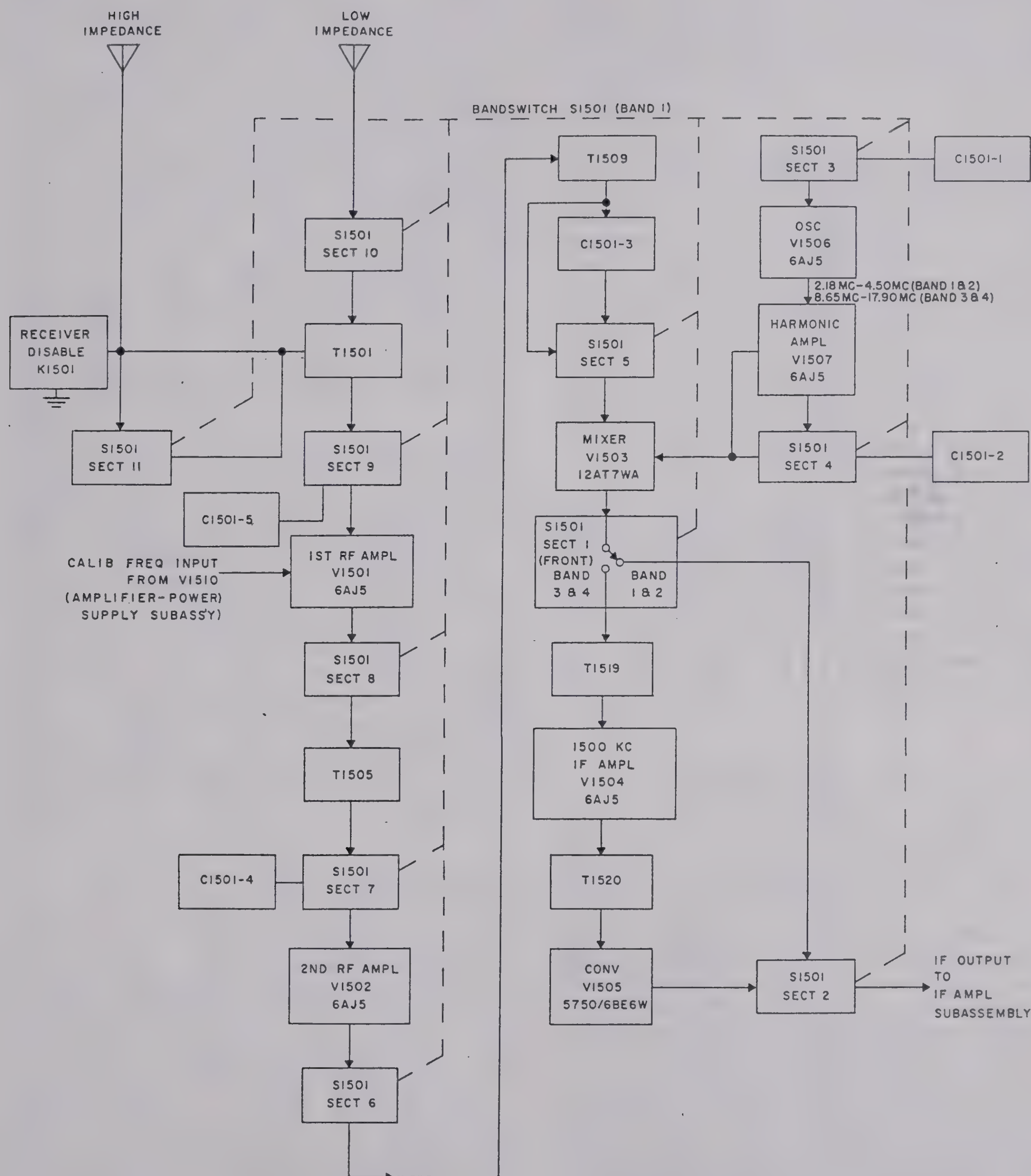


Figure 2-30. RF Head, Block Diagram

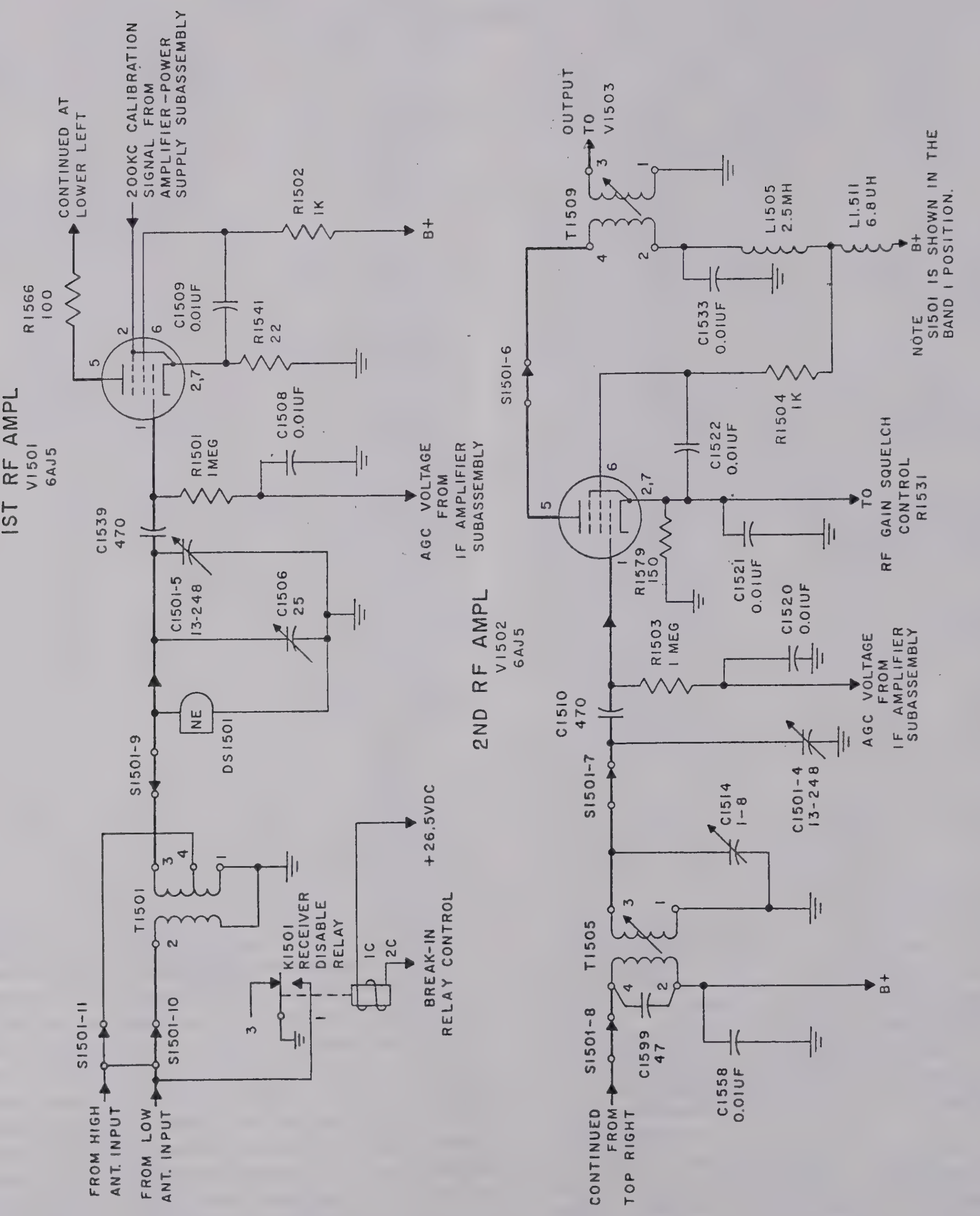


Figure 2–31. RF Amplifiers V1501 and V1502, Simplified Schematic

(3) LOCAL OSCILLATOR V1506 (6AJ5) AND HARMONIC AMPLIFIER V1507 (6AJ5). *(See figure 2–32.)* — Local oscillator stage V1506 is a modified tuned-plate oscillator with a tunable output in the frequency ranges of 2.18 to 4.5 mc (bands 1 and 2) and 8.65 to 17.90 mc (bands 3 and 4). A gang-tuned section of main tuning capacitor C1501 determines the oscillator frequency at any of the four bandswitch positions. Variable transformers T1513 and T1521, together with variable capacitors C1564 and C1591, are pretuned to align the oscillator and provide for correct tracking. The combination of T1513 and C1564 determines the local oscillator frequency in bands 1 and 2, while the combination of T1521 and C1591 determines the frequency in bands 3 and 4. The oscillator output is taken from the grid instead of from the plate to reduce tube loading effects and to increase stability.

Harmonic amplifier V1507 amplifies the fundamental and second harmonic components of V1506 local oscillator output and provides coupling to mixer stage V1503.

The output of oscillator tube V1506 is coupled through C1536 to the grid of V1507, a nonlinear amplifier with a high harmonic output. The plate circuit of V1507 is composed of four tuned circuits, each tuned in conjunction with C1501 (section 2).

Band 1 operation uses C1540 and T1514, which are tuned to the fundamental frequency range (2.18 to 4.50 mc) of the oscillator; band 2 operation uses C1542 and T1515 which are tuned to 1/2 (signal frequency plus 455 kc) (2.178 to 4.427 mc); band 3 operation used C1544 and T1516, which are tuned to the fundamental frequency range (8.70 to 17.90 mc); and band 4 operation uses C1545 and T1517, which are tuned to 1/2 (signal frequency plus 1500 kc) (8.65 to 17.75 mc). Each band of local oscillator outputs has overlap frequencies to allow for a one-percent overlap on each band of the reciver tuning dial.

(4) MIXER STAGE V1503 (12AT7WA) AND 1500-KC IF. AMPLIFIER V1504 (6AJ5). *(See figures 2–33 and 7–80.)* — Mixer stage V1503 uses a type 12AT7WA twin triode tube. The incoming signal from the second rf amplifier (V1502) is applied at the No. 1 grid (pin 7) of tube V1503, and the local oscillator signal from harmonic amplifier V1507 is injected at the No. 2 grid (pin 2).

Test Point TP–J1501 is connected to pin 2 of V1503 to check the output of the local oscillator V1506 and harmonic amplifier V1507. The signal input circuit of V1503 is tuned to the received rf frequency by the third of five ganged sections of the main tuning (TUNE) control, variable capacitor capacitor C1501.

The incoming signal from the second rf amplifier and the local oscillator input from harmonic amplifier V1507 are mixed in V1503. The difference frequency obtained for bands 1 and 2 is 455 kc, and for bands 3 and 4 is 1500 kc.

The 455-kc mixer output for bands 1 and 2 is applied directly to the 455-kc if. strip in the if. amplifier. For band 1, the signal path to the if. amplifier is through terminals 9 and 1 (section 1, front) and 2 and 10 (section 2, rear) of S1501, and through connector J1510. For band 2, the signal path is the same, except that terminals 9 and 3 (section 1) and 4 and 10 (section 2) of S1501 are used.

The 1500-kc mixer output for bands 3 and 4 must first be converted to 455 kc before being amplified by the 455-kc if. strip. The 1500-kc signal for band 3 is applied to the primary winding of T1519 through terminals 9 and 5 of S1501 (section 1, front), and coupled to the control grid of 1500-kc if. amplifier V1504 through the secondary of T1519 and C1569. The signal is then amplified and applied to the input signal grid (pin 7) of converter V1505 through transformer T1520. Band 4 operation is identical except that terminals 9 and 7 of S1501 (section 1, front) are used. The +21-volt plate supply for V1503 and V1504 is obtained from the amplifier-power supply subassembly. For Bands 1 and 2 the plate voltage for V1503 is taken from TB1501–3 and is applied through L1505, L1506, L1502, and terminals 10 and 2 or 4 of S1501 (section 2, rear) and terminals 9 and 1 or 3 of S1501 (section 1, front). For bands 3 and 4, the plate voltage for V1503 is taken from TB1501–3 and applied through L1505, L1506, R1527, the primary of T1519, and terminals 5, 7 and 9 of S1501 (section 1, front). Plate voltage for V1504 is applied only during operation on bands 3 and 4, as the stage is bypassed for the other bands. Plate voltage is applied to the tube through terminals 1 and 5 or 7 of S1501 (section 2, front).

(5) CONVERTER STAGE V1505 (6BE6). *(See figure 2–33)* — Pentagrid converter V1505 generates a 1955-kc signal and mixes it with the 1500-kc output from 1500-kc if. amplifier V1504 during operation on bands 3 and 4, to produce a 455-kc difference frequency necessary for amplification by the 455-kc if. strip in the if. amplifier. The incoming signal from V1504 is applied to T1520, which is resonant at 1500 kc, and applies a signal voltage on the input grid (pin 7) of V1505. Control grid (pin 1) is the oscillator grid. Pin 6 grids are utilized as the oscillator anode and as a shield for the input grid. Quartz crystal Y1502 is the main frequency-determining component, having an oscillation frequency of 1955 kc. The oscillator is free-running; feedback to sustain oscillations is coupled from the oscillator anode to the grid circuit through C1570. TPJ1502 is the test point for 1955-kc oscillator output. The 1955-kc oscillator output mixes the 1500-kc incoming signal to produce a difference frequency of 455 kc for amplification in the if. strip. For band 3 operation, the converter output from the plate of V1505 is applied to the if. strip through terminals 6 and 10 of S1501 (section 2, rear) to the if. amplifier. Band 4 signal path is identical, except that terminals 8 and 10 of S1501 (section 2, rear) are utilized.

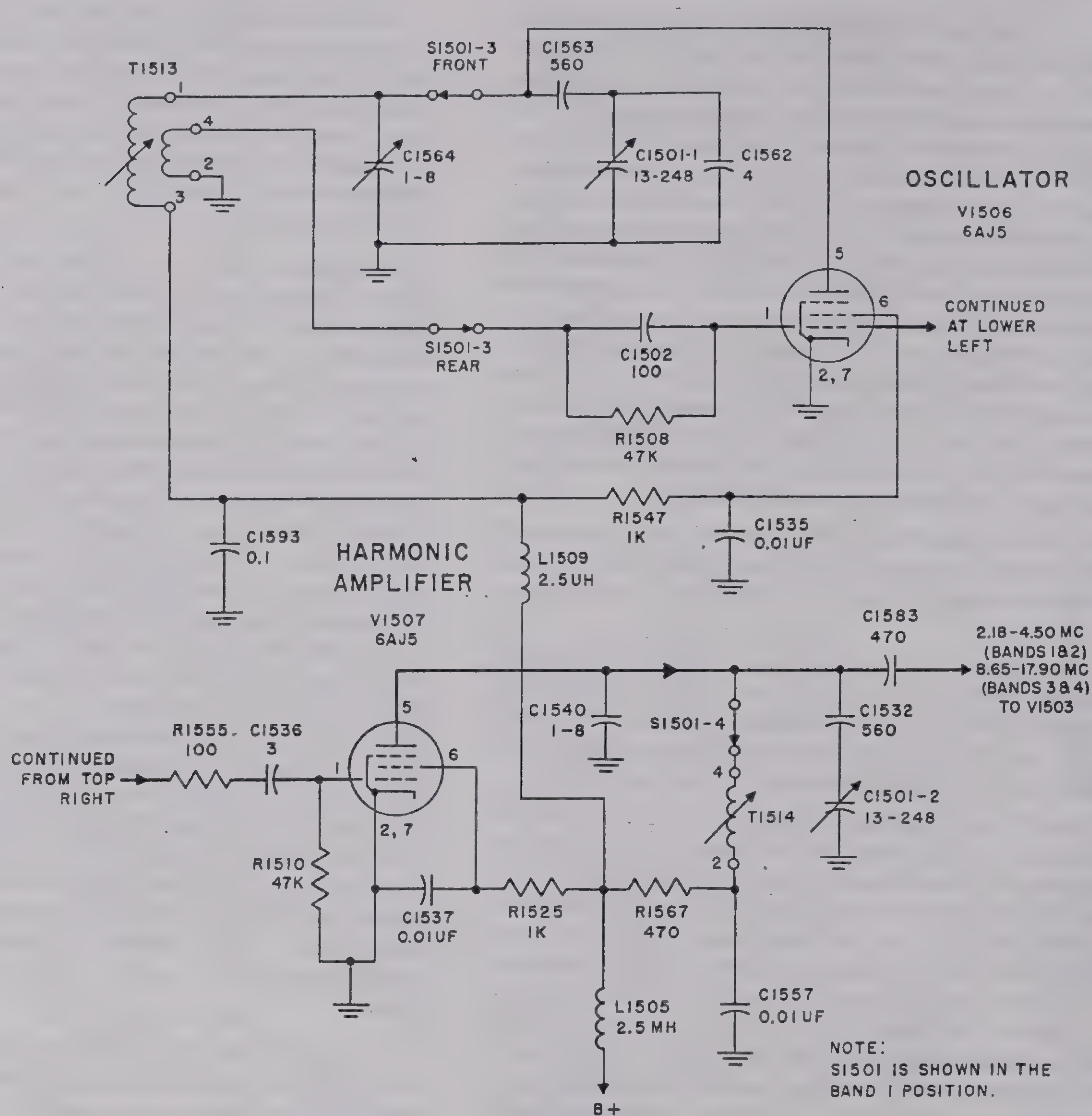


Figure 2-32. Local Oscillator V1506 and Harmonic Amplifier V1507, Simplified Schematic

The +21 volts is applied to the plate of V1505 only during operation on bands 3 and 4; the converter stage is not used for bands 1 and 2. Plate voltage is obtained from terminal 3 of TB1501, and is applied to the plate through L1505, L1506, L1502, and terminals 10 and 8 or 6 of S1501 (section 2, rear).

c. INTERMEDIATE FREQUENCY AMPLIFIER. *(See figures 2-34 and 7-82.)* — The if. amplifier is a removable plug-in subassembly containing four stages of if. amplification, a detector, an agc rectifier, and a bfo.

(1) IF. AMPLIFIERS V1601, V1602, V1603, V1604 (6AJ5). — The 455-kc intermediate frequency from the rf section of the receiver enters the if. strip at P1602 and is applied to the control grid of first if. amplifier V1601, through tuned first if. transformer T1601. Actually, there are several frequencies resulting from the heterodyning action in the mixer and converter stages that enter the if. strip. However, only the 455-kc difference frequency is amplified by the if. stages because of the tuned interstage if. transformers. Bandwidth of if. transformer T1601 can be changed from sharp to broad by operating the bandwidth selector switches S1601 through S1605, which are ganged with OPERATION SWITCH S1502 on the front panel. This varies the coefficient of coupling between the primary and secondary windings of T1601 and, consequently, affects the selectivity of the if. transformer. A sharp if. bandwidth of 3.5 ±0.5 kc, at the 6 db points, is used at all positons of the OPERATION SWITCH except BROAD PHONE and FSK, PHONE. These two positions employ a broad if. bandwidth of

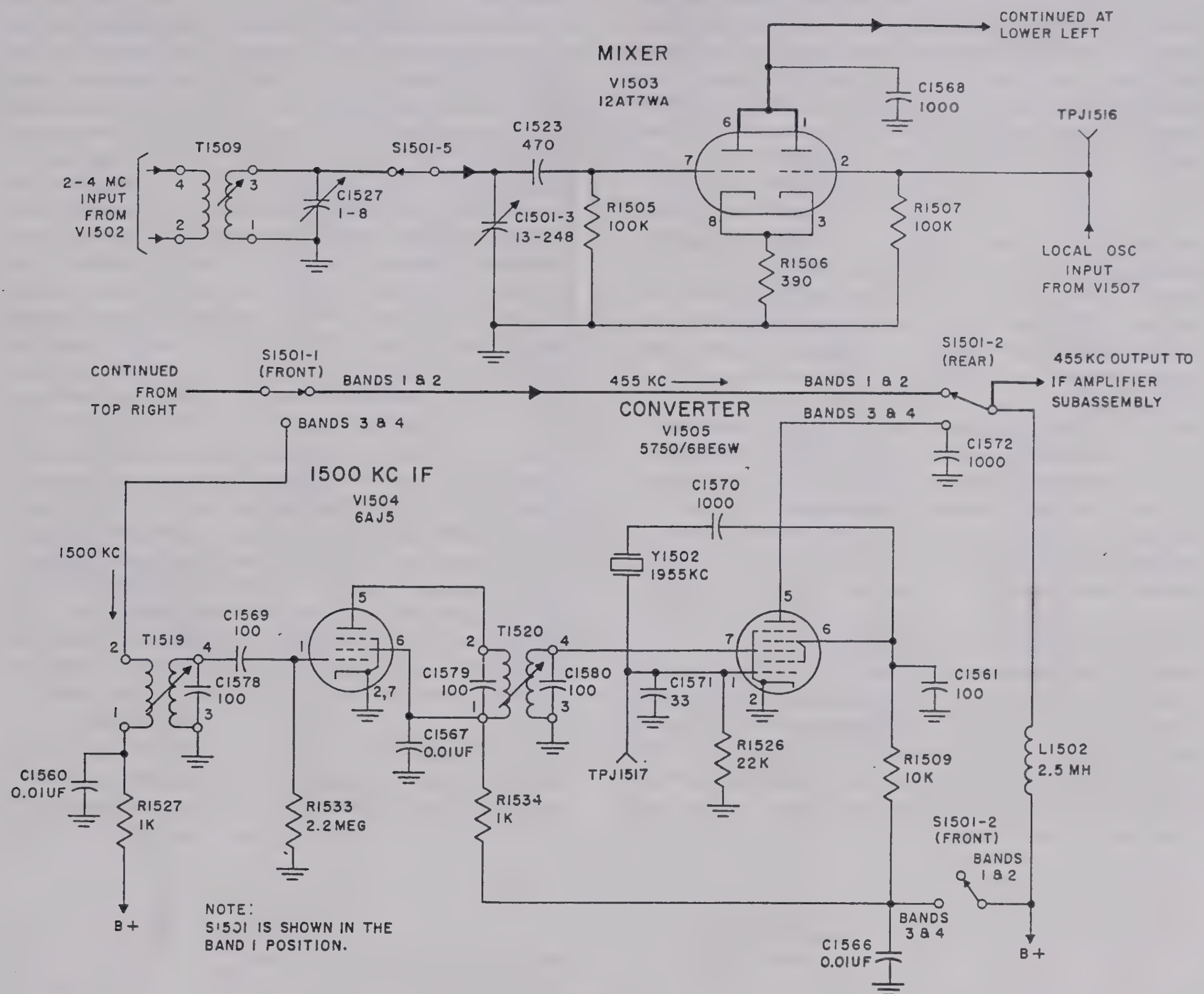


Figure 2–33. V1503, V1504, V1505 Stages, Simplified Schematic

7 ±1kc at the 6 db points. Amplifier stage V1601 is a conventional linear amplifier. Capacitor C1625 in the secondary of T1601 is part of the resonant circuit for the first if. transformer. C1601 is the control grid bypass capacitor and R1601 is the grid return resistor through the agc circuit. R1618 is the cathode decoupling resistor used to prevent unwanted interstage coupling and C1602 is the cathode bypass capacitor. C1603 is the screen bypass capacitor and R1619 is the plate decoupling resistor. Output of the first if. amplifier is coupled to the second if. amplifier, V1602, through the tuned circuit consisting of C1626, T1602 and C1627.

The second, third, and fourth if. amplifiers (V1602, V1603, V1604) operate in a manner similar to V1601 and therefore are not discussed.

Gain of the if. amplifiers is controlled by the manual RF GAIN SQUELCH control R1531 located on the receiver front panel. Gain of the first, second, and third if. amplifiers is also controlled by an agc voltage applied to their control grids from agc rectifier V1605B.

An output is taken from the plate of third if. amplifier tube V1603 and coupled through C1610, to connector P1603, to the input of the frequency shift converter subassembly. However, this unit is operative only when operating with OPERATION SWITCH S1502 in the FSK position.

Output of the fourth if. amplifier, V1604, is coupled to the plate and grid of detector V1605A through the fifth if. transformer, T1605. An output from the plate of V1604 is also coupled through C1614 to agc rectifier V1605B.

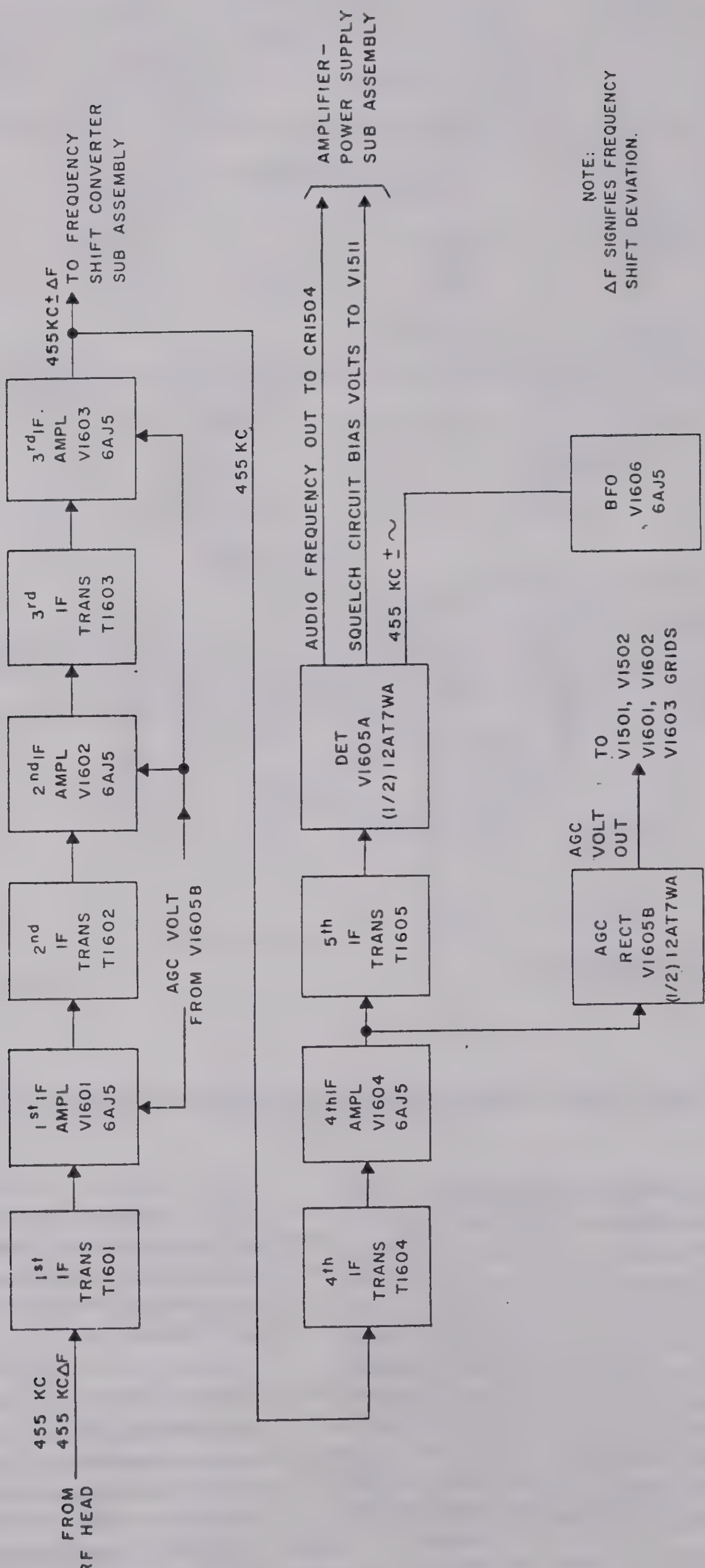


Figure 2–34. IF. Amplifier, Block Diagram

(2) DETECTOR STAGE V1605A (1/2 12AT7-WA). *(See figure 2–35.)* — Output signal of the fourth if. amplifier, V1604, at the intermediate frequency of 455 kc, is coupled through T1605 and applied to the plate and grid of detector V1605A. Tube V1605A is a triode having its plate and grid tied together so as to operate as a diode detector. The positive-going half of the signal causes V1605A to conduct. Conduction (electron flow) takes place from ground through the tube, through the secondary of T1605, and through detector load resistors R1611 and R1612, connected as a voltage divider. The rf is bypassed to ground through capacitors C1617 and C1619. Audio output is taken from the junction of R1611 and R1612 and fed to audio stages in the amplifier-power supply subassembly. R1610 and C1618 form an RC time constant combination for use in the noise limiter (CR1504) circuit located in the amplifier-power supply.

For reception of cw signals, output of beat frequency oscillator tube V1606 is coupled through C1616 to the plate of V1605A, for mixing with the received signal. Original frequencies and the sum and difference frequencies therefore flow through the secondary of T1605. However, only the difference frequency, which is in the audio range, is fed to audio stages in the amplifier-power supply subassembly. The two original frequencies and the sum frequency, which are in the rf range, are bypassed to ground through capacitors C1617 and C1619.

(3) AUTOMATIC GAIN CONTROL RECTIFIER V1605B (1/2 12AT7WA). *(See figure 2–36.)* — The incoming signal at the intermediate frequency of 455 kc is coupled from the plate of the fourth if. amplifier tube, V1604, to the plate and grid of agc rectifier tube V1605B through capacitor C1614. The plate and grid of triode V1605B are directly connected together, and thus the tube operates as a diode rectifier. Under no-signal conditions, this tube is not conducting; under input-signal conditions, the operating point of the tube is determined by the positive potential at the cathode developed across cathode resistor R1613 and dropping resistor R1605, which are in the plate supply line.

Rectifier V1605B will conduct only on the positive-going half of the incoming signal, and conduction will take place through R1613, V1605B, and through R1608 to ground. Voltage drop across R1608, the agc load resistor, will cause a negative potential to exist as its ungrounded end. This negative potential is applied through R1607 to the agc line as a bias for the rf amplifiers during phone operation, and to the first three if. amplifiers. The amplitude of the bias voltage developed across R1608 will be determined by the amplitude of the incoming signal. This will tend to keep the signal level through the front end of the receiver at a constant level. R1607 and C1615 comprise an RC filter in the agc line to eliminate audio voltage variations.

(4) BEAT FREQUENCY OSCILLATOR STAGE V1606 (6AJ5). *(See figure 2–37.)* — The bfo is a conventional shunt-fed Hartley oscillator. The oscillator tank circuit is composed of C1623, C1622, C1638 and L1602. BFO PITCH control C1623 is a variable, air-dielectric capacitor adjusted from the front panel to produce an audible note of the desired pitch. Coil L1602 is a tapped coil which has a tunable iron core

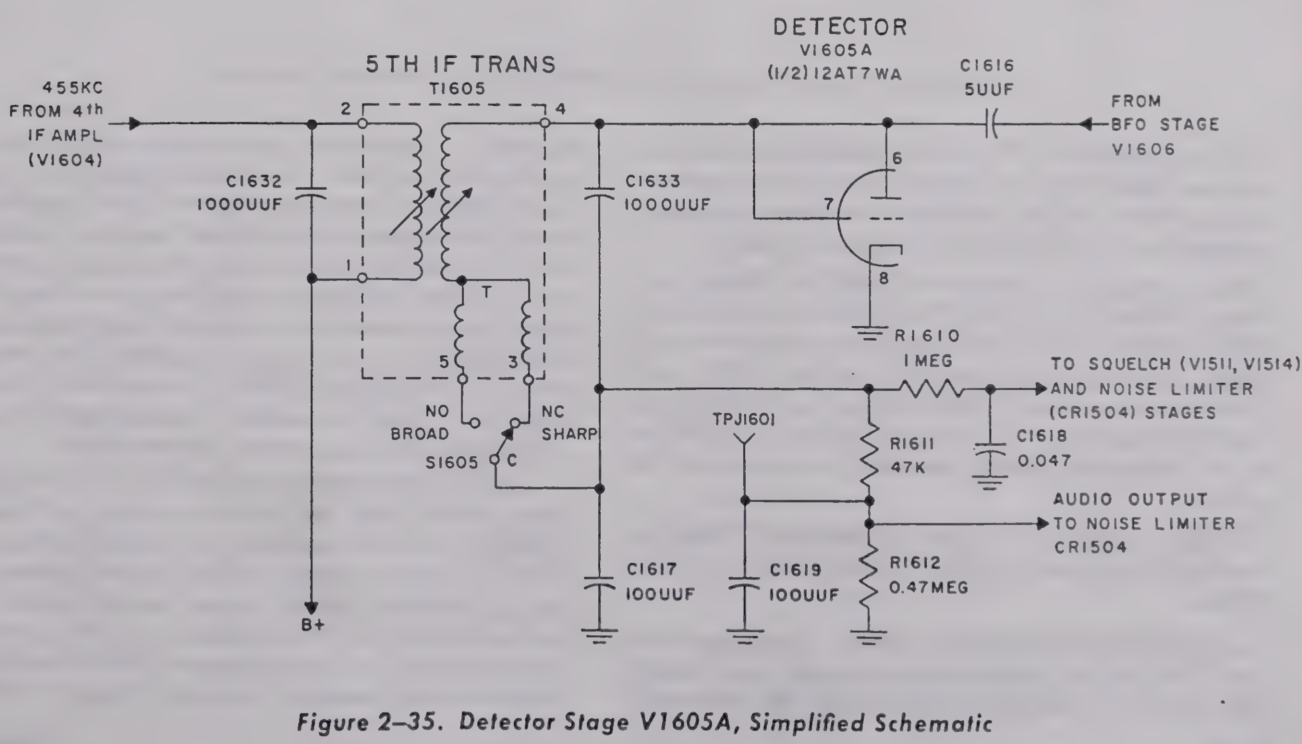


Figure 2–35. Detector Stage V1605A, Simplified Schematic

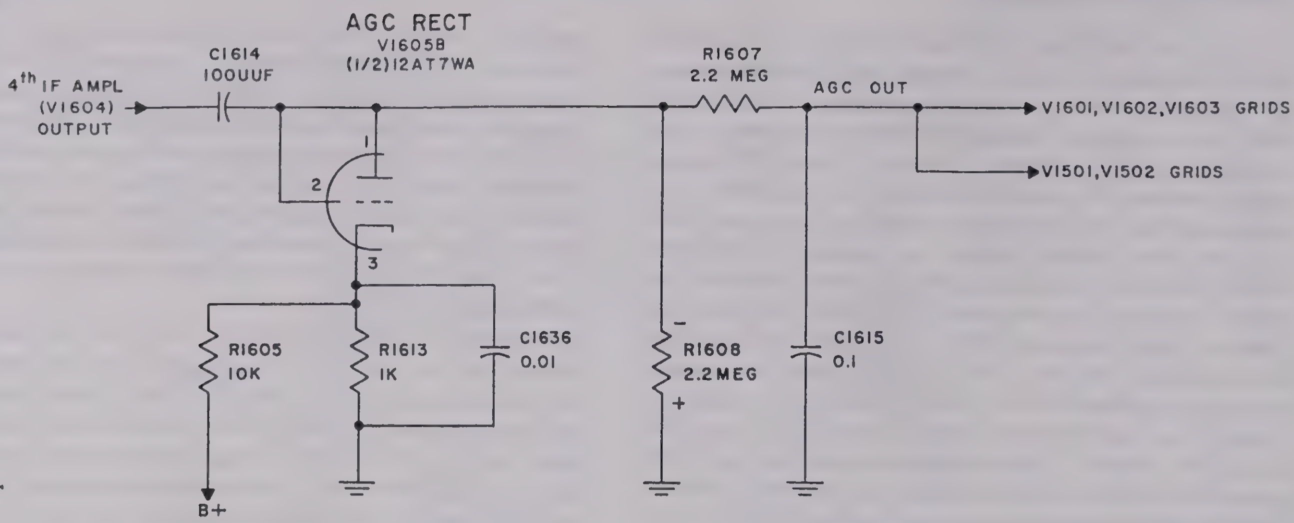


Figure 2–36. AGC Rectifier V1605B, Simplified Schematic

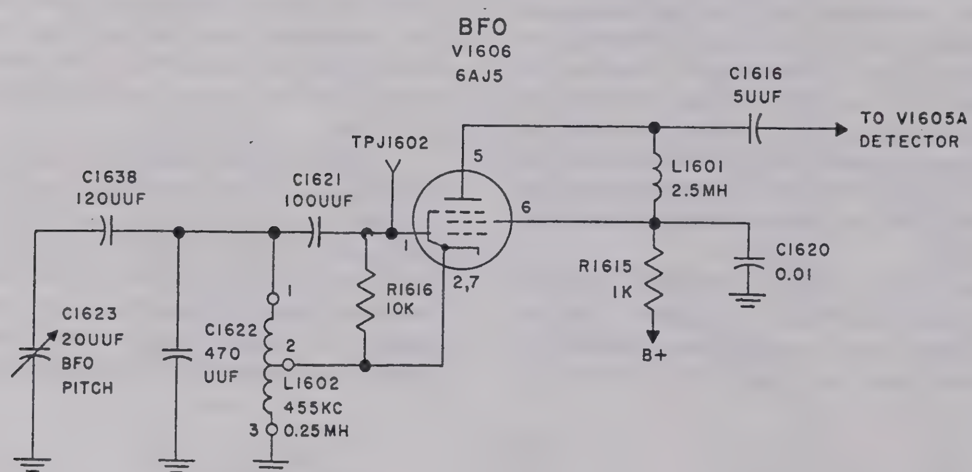


Figure 2–37. Beat Frequency Oscillator V1606, Simplified Schematic

for fine adjustment. The coil is pretuned at the factory, and should not be adjusted under normal operating conditions. Slight changes in oscillator frequency are made with the BFO PITCH control C1623.

Plate and screen voltage for V1606 is applied only when OPERATION SWITCH S1502 is in the CAL, CW SHARP, or CW, FSK BROAD position. At such times, +21-volts dc is applied through R1615 and L1601 to the plate of V1606. Screen voltage is taken from the junction of R1615 and L1601. Coil L1601 is an rf decoupling choke, and R1615 is a decoupling resistor.

Output from beat frequency oscillator V1606 is coupled to the plate of detector tube V1605A through C1616.

d. AMPLIFIER-POWER SUPPLY. *(See figures 2–38 and 7–84.)* — The amplifier-power supply is a removable plug-in subassembly containing the following circuits: a noise limiter and squelch circuit; a triode-type audio amplifier; a cathode follower; an audio driver stage; a transistor push-pull final amplifier; a crystal calibration oscillator and harmonic amplifier; and the receiver power supply components consisting of a rectifier, filter, and transistorized voltage regulator. Input power to the receiver is initially applied to the amplifier-power supply subasembly for rectification (if Radio Set AN/MRC-55 is operating from an external 115-volt, ac source), voltage regulation, and distribution to other receiver subassemblies.

(1) NOISE LIMITER CIRCUIT CR1504 (1N69). *(See figures 2–35 and 2–39.)* — Output of detector V1605A, in the if. amplifier, is applied to the anode of noise limiter crystal CR1504 (a germanium rectifier). The audio voltage output across detector load resistors R1611 and R1612 causes a negative potential to be developed at the junction of R1611 and R1610. This negative potential is applied through R1610 to

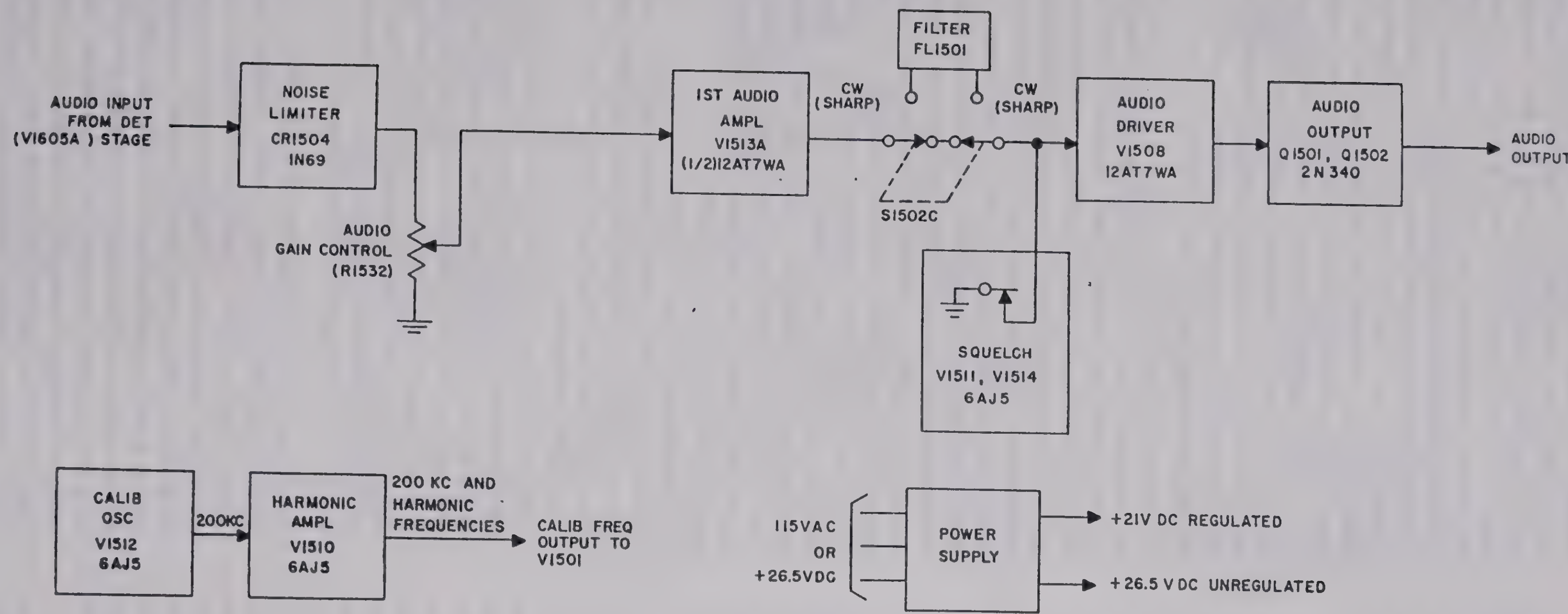


Figure 2–38. Amplifier-Power Supply, Block Diagram

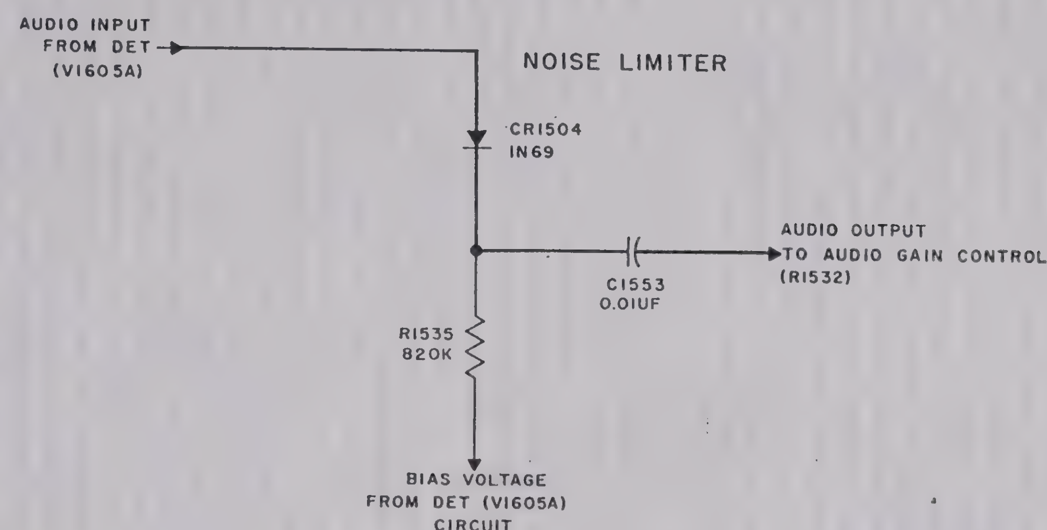


Figure 2–39. Noise Limiter Stage CR1504, Simplified Schematic

C1618, building up on this capacitor a negative charge approximately equal to the total detected voltage between terminal 5 of T1605 (or terminal 3, in the SHARP position of S1605) and ground. This negative potential is used as a bias for CR1504, and is applied to the rectifier cathode through resistor R1535. The audio frequency component of the detected voltage is taken from the detector circuit at the junction of voltage divider resistors R1611 and R1612 and applied to the anode of noise limiter crystal CR1504. Consequently, the cathode of CR1504 is more negative than the anode and a current path for the audio frequency is established through the diode.

In the event that a sharp pulse of noise is received, the long time-constant of R1610 and C1618 does not permit capacitor C1618 to charge to the higher transient voltage. However, the voltage at the junction point of R1611 and R1612 rapidly follows the change, placing the anode of CR1504 at a more negative potential than the cathode, thereby stopping conduction for the duration of the noise pulse and preventing the noise pulse from reaching the audio amplifier stages.

The af signal is coupled to the control grid of the first af amplifier, V1513A through capacitor C1553, front panel audio gain control R1532, and capacitor C1576.

(2) AUDIO AMPLIFIER V1513A (1/2 12AT7-WA) AND CATHODE FOLLOWER V1513B (1/2 12AT7WA). *(See figure 2–40.)* — Audio amplifier V1513A is a conventional linear amplifier operating in the audio range. The audio output from noise limiter CR1504, after attentuation by front panel AUDIO GAIN control R1532, is coupled to the control grid of V1513A through capacitor C1576. Output of V1513A is coupled through C1588 to the grid of cathode-follower V1513B. The cathode follower is employed in order to obtain a low impedance to match the impedance of bandpass filter FL1501. Output of V1513B is coupled through C1552 to wafer C of OPERATION SWITCH S1502. When S1502 is at the CW SHARP position, the audio signal passes through bandpass filter FL1501, which has a center frequency of 1000 cps. Bandwidth of the filter at 6 db down is 350 cps, and bandwidth at 40 db down is 700 cps. Consequently, interference sources are greatly attenuated. When the OPERATION SWITCH is at any other position, bandpass filter FL1501 is bypassed and the audio output from V1513 is fed directly to the grid of audio driver stage V1508.

(3) SQUELCH CIRCUIT V1511 (6AJ5) AND V1514 (6AJ5). *(See figures 7–78, 7–84, and 2–41.)* — The squelch circuit is employed during BROAD PHONE service to provide silent operation of the receiver during times of no-signal reception. This is accomplished by grounding the input (pin 7) of audio driver V1508 through contacts 3 and 4 of de-energized relay K1502.

When OPERATION SWITCH S1502 is set at any position except BROAD PHONE, K1502 is energized through R1519 and S1502A (front) by the +21-volt supply. Thus, contact 3 of K1502 is removed from ground and the audio signal is amplified by V1508. When S1502 is set at BROAD PHONE the +21 volts is removed from the coil of K1502 and the squelch circuit functions as follows: During times of no-signal reception, V1511 conducts freely, providing its cathode circuit is connected to ground via S1505. (S1505 is ganged to R1531 and is closed except when R1531 is rotated to its extreme counterclockwise position.) Tube V1511 plate current through R1551 develops a negative-going potential at the plate end of the resistor which is also connected to the control grid of V1514. This negative potential keeps V1514 cut off. With V1514 cut off, cathode current (K1502 coil current) does not flow and thus K1502 is de-energized. When K1502 is not energized, contacts 3 and 4 are closed, grounding the input to V1508.

During times of signal reception, a negative potential is applied to the control grid of V1511 from the junction point of detector load resistors R1611 and R1610 in the if. amplifier subassembly. The magnitude of this negative potential is proportional to the detected signal level which, in turn, is adjusted with RF GAIN SQUELCH control R1531 which varies the gain of the second rf amplifier and the if. amplifiers. For proper squelching, R1531 is adjusted to the point where the negative potential applied to the control grid of V1511 is sufficient to drive the tube to cut off. With no plate current flowing, there is no voltage drop across R1551 and, therefore, there is no bias applied to the V1514 grid. V1514 conducts through the coil of K1502 which energizes the relay and removes the ground from the input to V1508, allowing amplification of the audio signal.

If squelch operation is not desired, R1531 is rotated to its extreme CCW position. This opens S1505, which cuts off V1511 cathode current. As described above, when V1511 is cut off, V1514 conducts and squelch relay K1502 energizes.

The squelch circuit is also used to provide a separate feature of the radio set. The equipment is designed so that it can be used as an automatic two-way relay station for reception and retransmission of am. signals. The action of squelch relay K1502 also causes contacts 4 and 2 to close. When the transmitter is set for RELAY operation, contacts 2 and 4 complete a circuit which energizes the transmitter.

(4) AUDIO DRIVER V1508 (12AT7WA) AND AUDIO OUTPUT STAGE Q1501 (2N340) AND Q1502 (2N340). *(See figure 2–40.)* — Audio driver V1508 is a twin triode having its sections connected in parallel. When the squelch circuit is employed during phone operation, the grid circuit of V1508 is grounded through the contacts of squelch relay K1502 to provide silent operation of the receiver during times of no-signal reception. The amplified output from V1508 is applied to the primary winding of T1522, the input to audio output stage Q1501, Q1502.

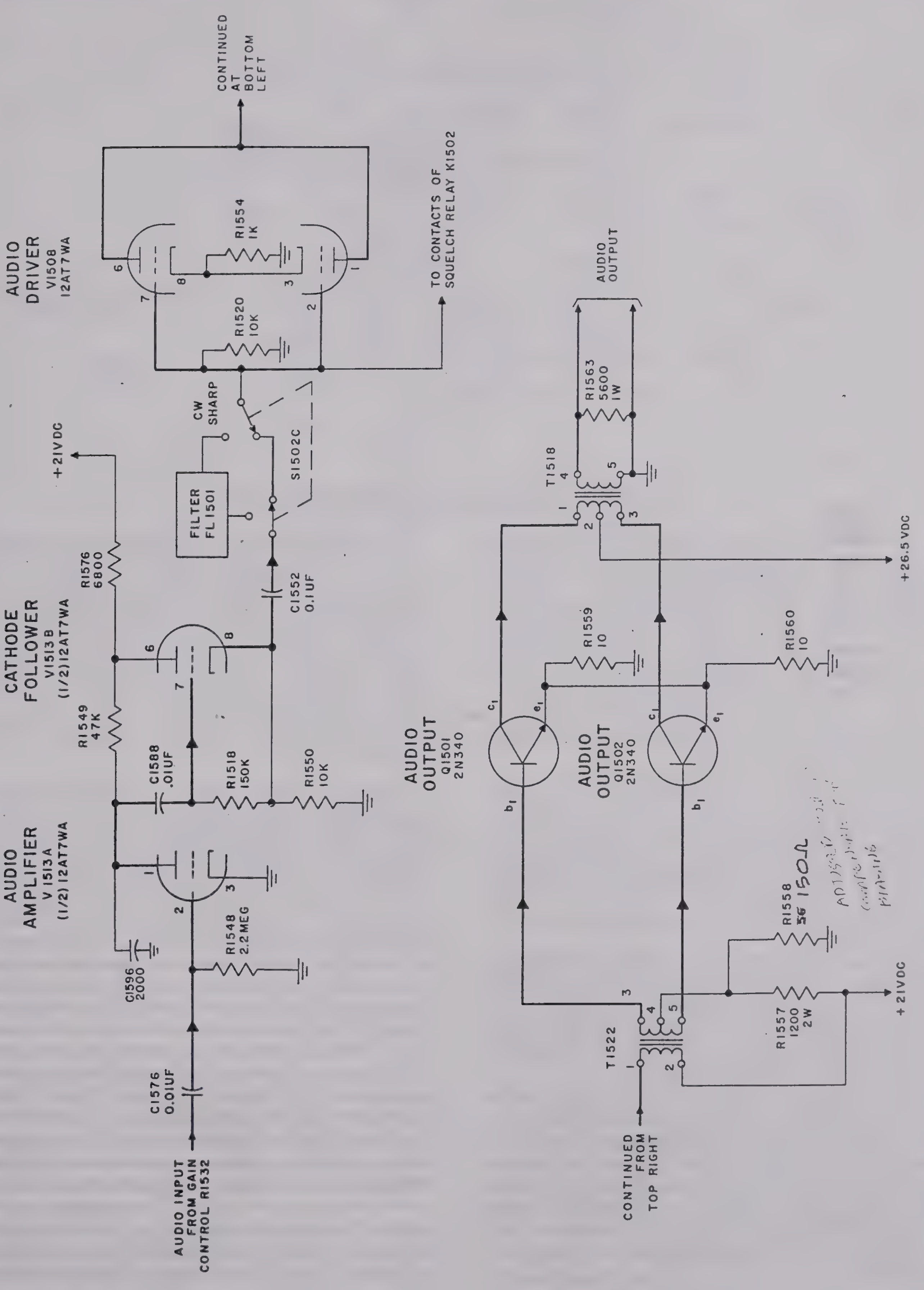


Figure 2–40. Audio Amplifier Stages V1513A, V1513B, V1508, Q1501, Q1502, Simplified Schematic

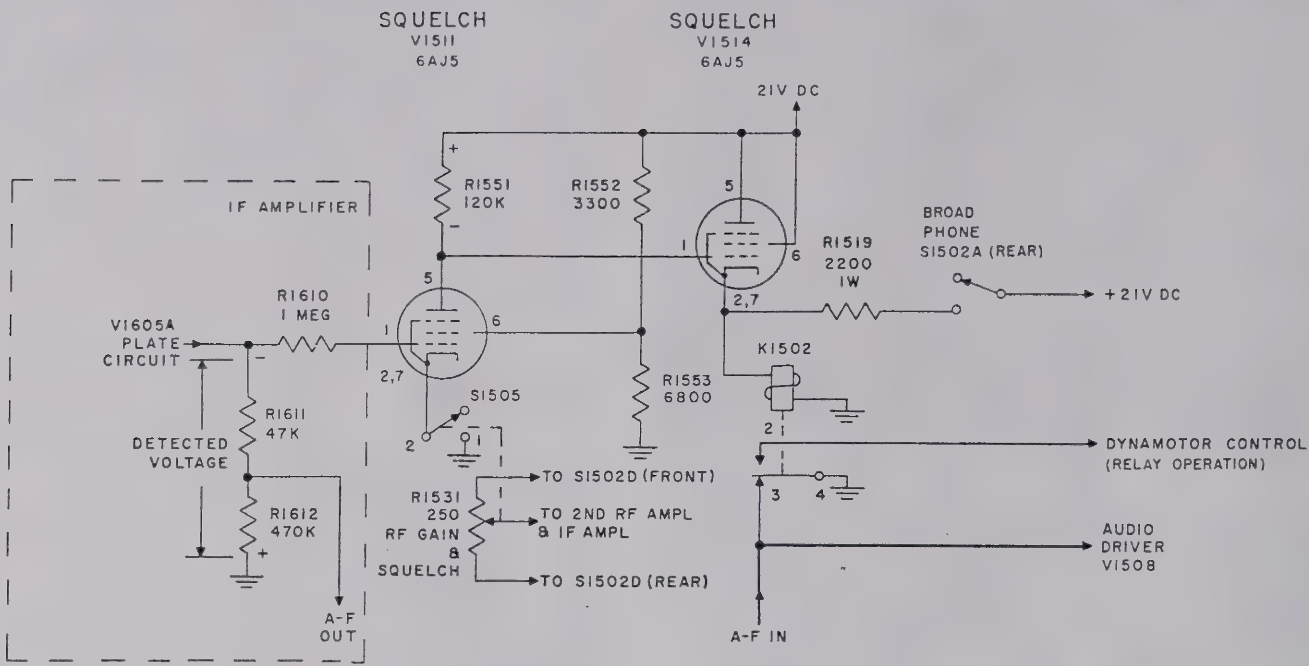


Figure 2–41. Squelch Circuit, Simplified Schematic

The audio output stage consists of two type-2N340 transistors operating in push-pull. They are NPN junction-type transistors connected in a common-emitter configuration, to give large current amplification and high power gain. This usage is analogous to a conventional vacuum-tube triode amplifier, in that the base (b1) is connected as the control grid, the collector (c1) is connected as the plate, and the emitter (e1) is connected as the cathode. As such, the functional operation can be considered the same as a class B, push-pull amplifier stage.

Collector voltage is applied through the primary winding of T1518 from the +21-volt bus. Base bias voltage is obtained from the junction point of R1558 and R1557. These resistors are connected as a voltage divider across the +21-volt supply and, therefore, the positive bias voltage obtained is less than 1 volt. R1559 and R1560 are current limiting resistors in series with the emitters.

The push-pull outputs from Q1501 and Q1502 are combined in T1518 and coupled to audio receptacles on the receiver and transmitter front panels and are applied to the trasmitter for retransmission when the radio set is used for relay service. Resistor R1563 is an output impedance-matching resistor.

(5) CALIBRATOR OSCILLATOR V1512 (6AJ5) AND HARMONIC AMPLIFIER V1510 (6AJ5). *(See figures 2–38 and 2–42.)* — Calibrator oscillator V1512 and harmonic amplifier V1510 are used to produce a signal for use in calibrating the receiver main tuning dial. Plate voltage is applied to V1512 and V1510 only when OPERATION SWITCH S1502 is in the CALIBRATE position. These stages are inoperative at all other times.

Oscillator stage V1512 is a modified electron-coupled Pierce oscillator having an output frequency of 200 kc. Quartz crystal Y1501 is the main frequency determining component and variable capacitor C1547 is a trimmer in the oscillator grid circuit. TPJ1503 is the test point for the oscillator. Feedback to sustain oscillations is coupled from the oscillator anode (screen grid) to the grid circuit through C1548. The 200-kc output is taken from the plate of V1512 and coupled to the grid circuit of harmonic amplifier V1510 through C1550.

Harmonic amplifier V1510 is a non-linear amplifier used to amplify the fundamental frequency of 200 kc, and to supply strong harmonics of that frequency. To accomplish non-linear amplification and resultant harmonics, crystal rectifier CR1501 is placed in the grid circuit to distort the 200-kc signal. Output from the plate of V1510 is coupled through C1577 and applied to the cathode of first rf amplifier V1501 in the rf head. The output from the harmonic amplifier heterodynes with the output from the local oscillator circuitry in the rf head to produce an audible beat note at 200-kc intervals throughout the receiver range. If the fiducial pointer on the tuning dial is correctly lined up, a zero beat will be heard when a dial calibration mark lies under the pointer; if not, the operator moves the pointer until this condition is obtained.

(6) RECEIVER POWER SUPPLY. *(See figure 2–43.)* — All input power to the receiver is applied through the power supply and transmitter main chassis to the receiver power supply. Two outputs are distributed throughout the receiver by the receiver power supply, an unregulated +26.5-volts dc and a regulated +21-volts dc. A full-wave rectifier circuit, comprised

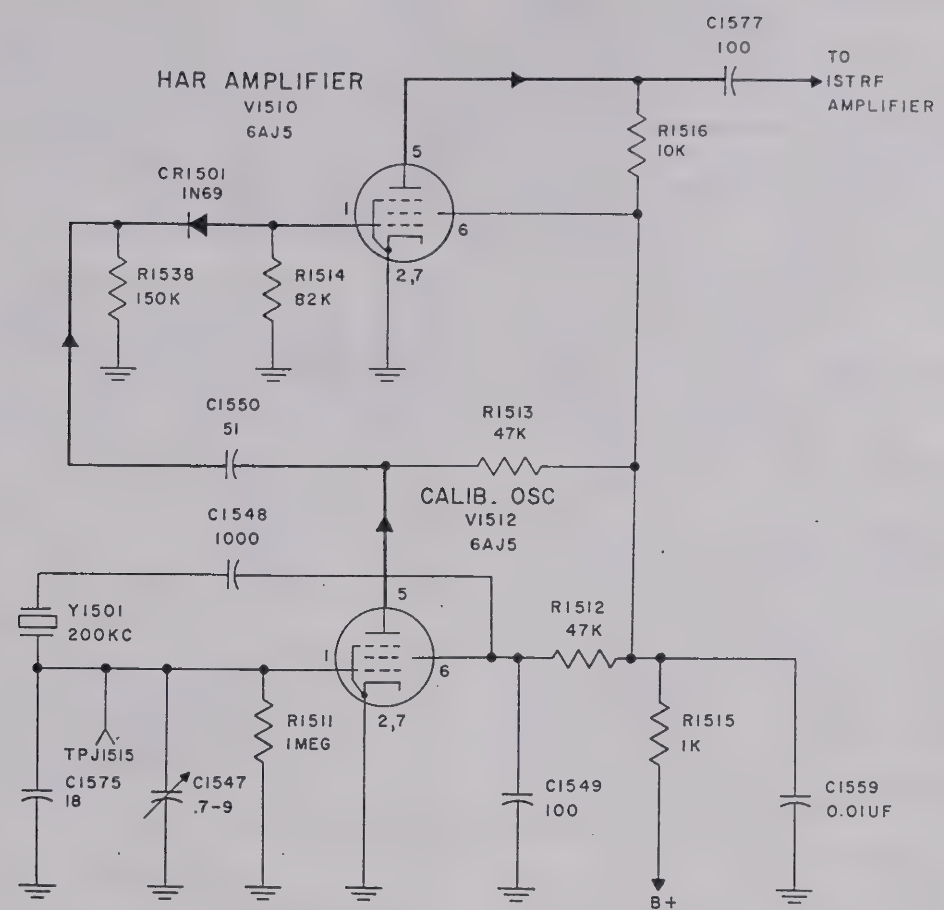


Figure 2–42. Calibrator Oscillator Stages V1512 and V1510, Simplified Schematic

of T1521 and silicon diodes CR1502A and CR1502B, as in or out of the supply depending on whether an ac or dc input is applied. A transistorized voltage regulator, used with ac or dc input, is the final section of the receiver power supply.

Components comprising the voltage regulator circuitry are physically located in the amplifier-power supply assembly and on the interior of the receiver front panel. The latter location is used so that the front panel can serve as a "heat sink" to dissipate the heat generated by the transistors.

When the vehicular generator system is used as the input power source, +26.5 volts, applied to terminal 10 of P1504, protected by fuse F1503, is the input voltage to the regulator circuit (VR1501, terminal 1). The +26.5-volt unregulated supply is taken before the regulator and delivered to terminal 23 of P1504 for further distribution.

When an external 115-volts ac is used as the input power source, input voltage is applied to terminals 19 and 20 of P1504. Step-down transformer T1521 and full wave rectifier CR1502A, CR1502B, and filter L1507 and C1573 convert the alternating source to +26.5 volts. The +26.5-volt output of the rectifier-filter combination is applied to terminal 1 of voltage regulator assembly VR1501.

The voltage regulator circuitry compensates for variations in the +26.5-volt input supply and for changes in load current, thereby maintaining the output at a constant +21 volts. Q1504, Q1503, and the parallel combination of Q1505 and Q1506 are connected in series across the +21-volt output terminal (J1512-3). A decrease in the output voltage causes the Q1505-Q1506 collector current to increase since these are NPN-type transistors. This current increase is amplified by Q1503, causing the output voltage to increase. The output voltage level (+21 volts) is determined by the gain of Q1503. The Q1503 gain is determined by the amount of bias applied to its base and this bias level is established by the amount of Q1504 collector current. Zener diode CR1505 functions in a manner analogous to a voltage-regulator tube to maintain a constant bias at the Q1504 base. Q1504 conduction can be varied with potentiometer R1564 which adjusts

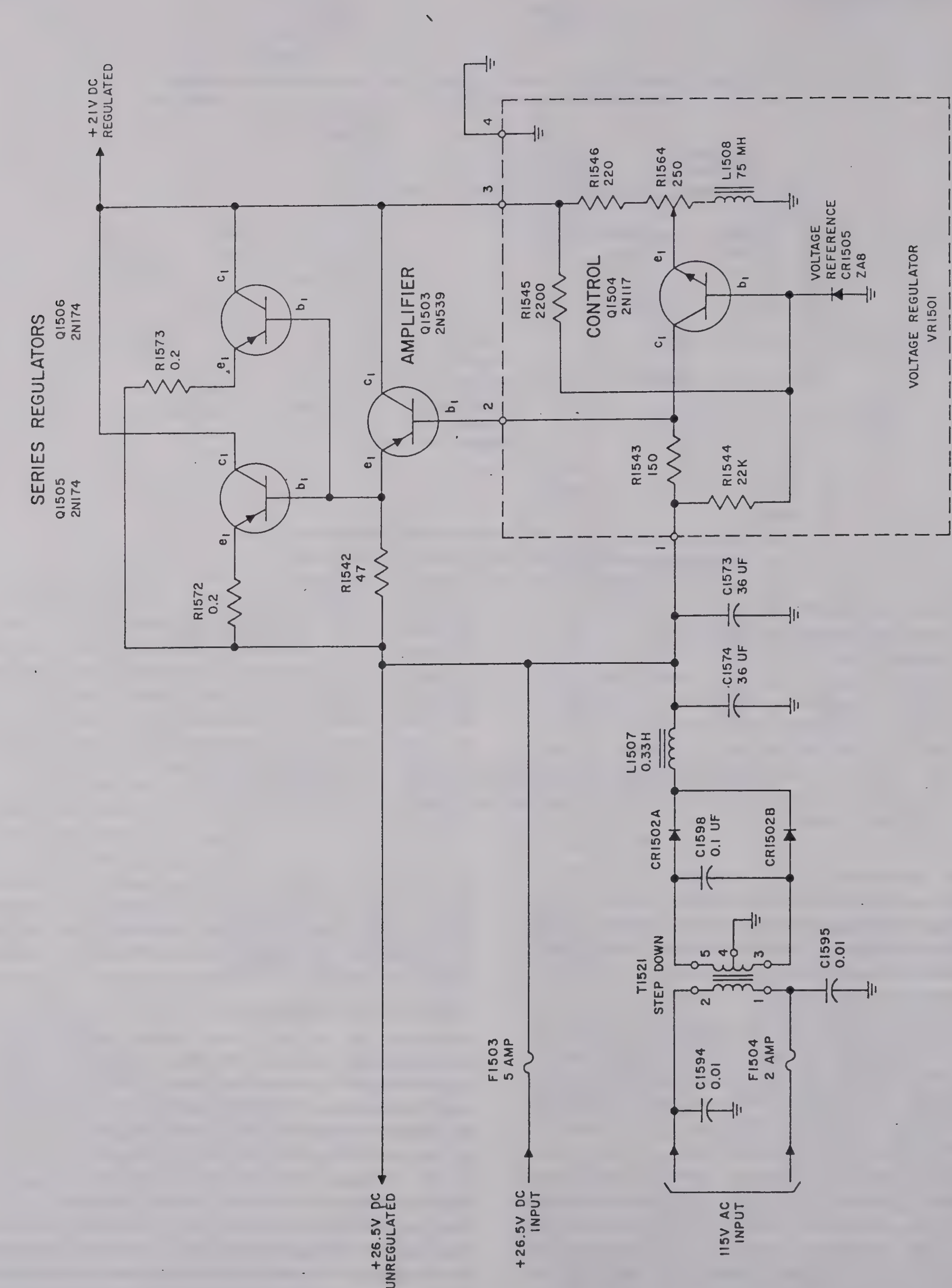


Figure 2–43. Receiver Power Supply, Simplified Schematic

the emitter voltage. Since R1564 can vary the Q1503 base bias, it is used as the +21 volt output adjustment. The Q1503 gain is also determined by the +26.5-volt input applied through R1543 to the collector of Q1504 and base of Q1503. If the supply voltage decreases (becomes less positive) the Q1504 collector current increases and the Q1503 current gain increases, thereby maintaining the output at its +21 volt level.

e. FREQUENCY SHIFT CONVERTER. — Two types of frequency shift converter are provided for use with the receiver. The converters supplied as part of the R–808/6RC/14 receivers having serial numbers 1 through 115 inclusive utilize a mark-space discriminator circuit operating in the audio frequency range. Receivers having serial numbers greater than 115 use a discriminator operating about the 455-kc intermediate frequency. Thus, the converters supplied with the lower-numbered receivers are referred to as "FS Converter, AF Type", while the later production models use "FS Converter, IF. Type".

For explanatory purposes in the following descriptions, the mark signal at the if. frequency is referred to as 455 kc $+\Delta f$ and the space signal is 455 kc $-\Delta f$. (In both expressions, Δf signifies the frequency shift deviation employed at the transmitting station.) The text and drawings follow this procedure throughout. In actual practice this is not always the case. It is just as correct to reverse the terminology and refer to the space signal as 455 kc $+\Delta f$ and the mark signal as 455 kc $-\Delta f$. The mark and space signals will be above or below the if. frequency in accordance with either of the following two factors:

characteristics of the transmitting station or
band being received.

The receiver uses single conversion during operation on bands 1 and 2 and double conversion on bands 3 and 4. (See paragraphs 2–6*a* and *b*.) During operation on bands 1 and 2, a received mark signal having a $+\Delta f$ is converted to a 455 kc $-\Delta f$ signal. However, since there is double conversion on bands 3 and 4, the additional heterodyning causes the mark signal to be at a frequency of 455 kc $+\Delta f$.

The front panel NORMAL-REVERSE switch changes the connections to the teletypewriter to compensate for the above factors.

(1) FS CONVERTER, AF TYPE. *(See figures 2–44 and 7–86.)* — The af type converter is a removable plug-in subassembly. Plate voltage is applied to the unit only when OPERATION SWITCH S1502 is at the CW, FSK BROAD and FSK PHONE positions.

Frequency shift transmissions, shifted at an audio rate about the 455 kc if. frequency, from V1603 in the if. subassembly, are amplified and demodulated to operate a keying relay which is connected to an external teletypewriter.

Figure 2–45 illustrates the waveforms produced during the conversion process.

(*a*) IF. AMPLIFIER STAGE V1701 (26A6). *(See figure 2–46.)* — The output signal of the third if. amplifier, V1603, at the mark frequency of 455 kc $+\Delta f$

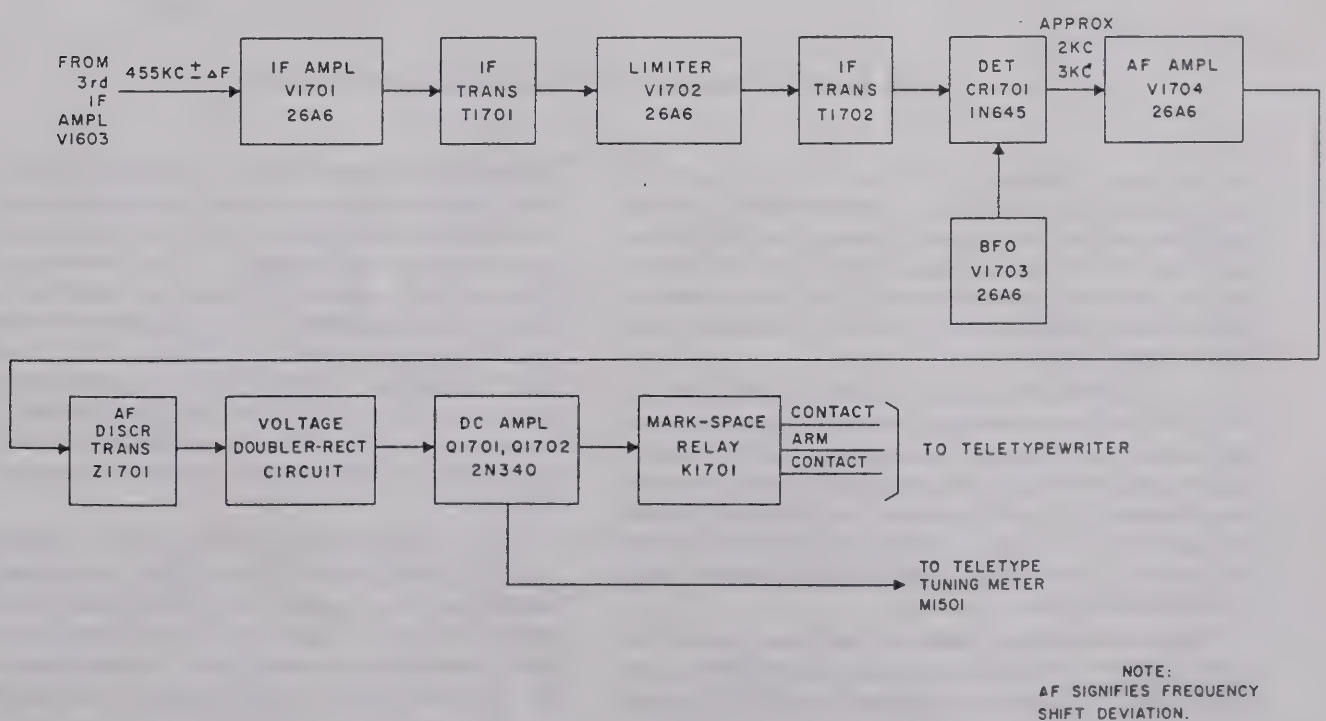


Figure 2–44. FS Converter, AF Type, Block Diagram

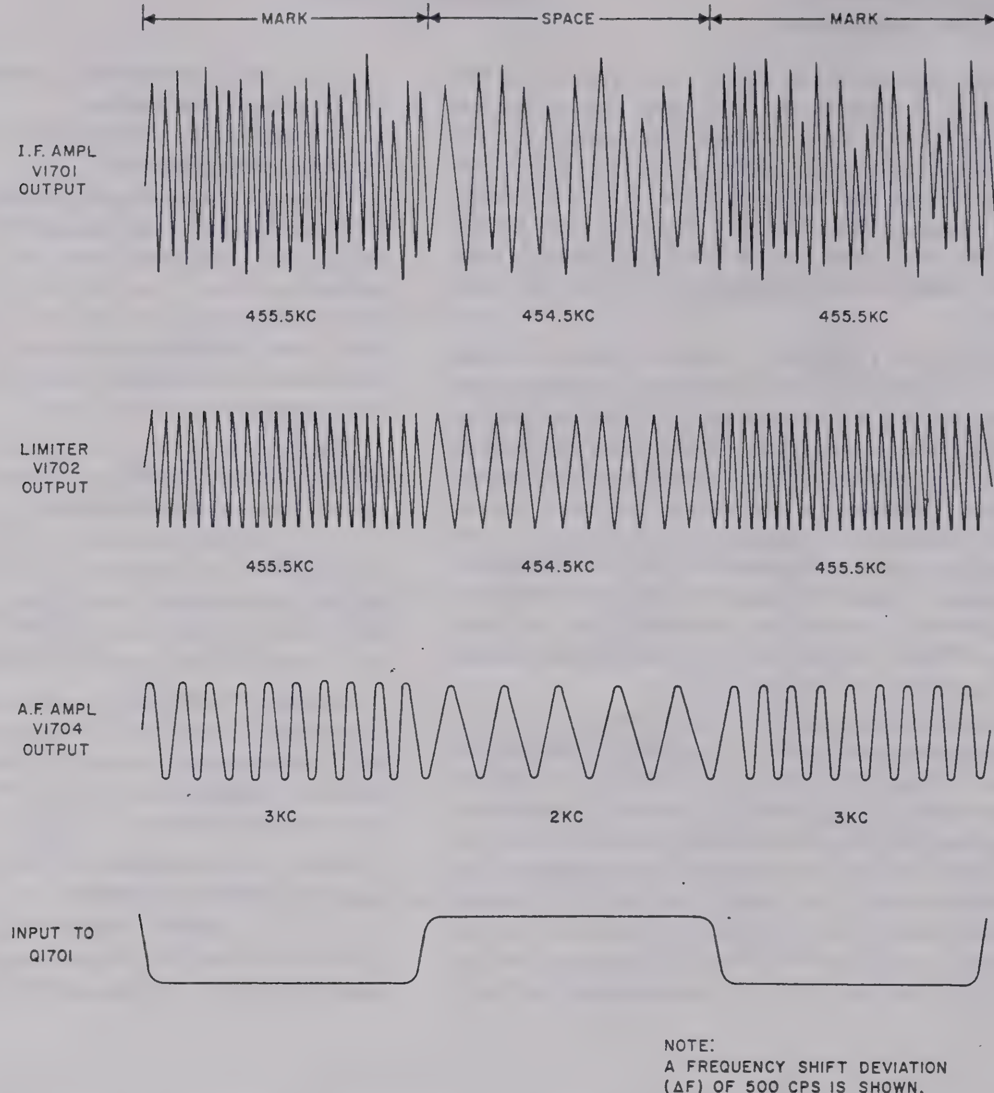


Figure 2–45. FS Converter, AF Type, Theoretical Waveforms

and the space frequency of 455 kc —Δf is applied to the control grid of V1701, a conventional pentode amplifier used to provide the gain required for proper operation of the limiter stage. Output of the tube is coupled through if. transformer T1701 to the control grid of limiter tube V1702. T1701 is a bandpass transformer tuned to 455 kc.

(*b*) LIMITER STAGE V1702 (26A6). *(See figure 2–46.)* — Since the space and mark signals are actually a form of frequency modulation, the limiter removes noise peaks and other amplitude variations without affecting the intelligence of the incoming signal. Output from if. amplifier V1701 is applied to the control grid of limiter tube V1702, which operates as an overdriven amplifier.

During the positive peaks of the input signal, the plate is driven to saturation, grid current flows, and consequently a charge is developed on C1702. During negative half-cycles, C1752 discharges through R1702 thereby developing a grid-leak bias which drives V1702 to cutoff. In this way the tube is biased to a level proportionate to the strength of the incoming signal. Positive and negative clipping are obtained because the signal operates both in the plate saturation and cutoff regions of the tube. Although the limiting is not symmetrical, it is sufficient to operate the type of discriminator circuitry used in this converter. Output from the plate of V1702 is coupled across 455 kc if. transformer T1702 to the input of detector stage CR1701.

(*c*) DETECTOR STAGE CR1701 (1N645) AND AUDIO AMPLIFIER V1704 (26A6). *(See figure 2–46.)* — Output from limiter V1702 is applied to CR1701 for conversion to audio mark and space frequencies. The incoming frequency shift transmissions at 455 kc +Δf and 455 kc —Δf are mixed with the 452.5-kc

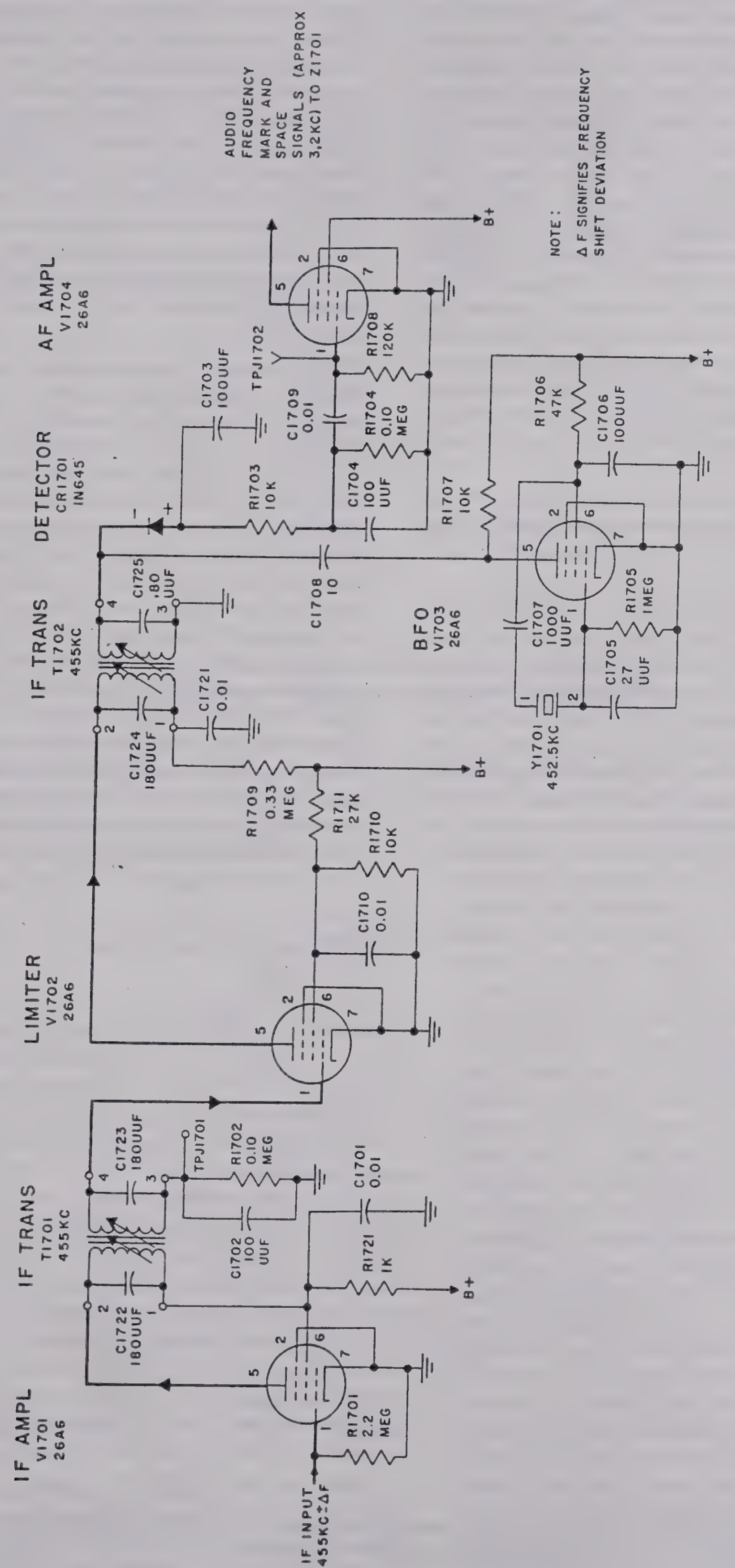


Figure 2-46. FS Converter, AF Type, Stages V1701, V1702, V1703, V1704, CR1701, Simplified Schematic

output of bfo stage V1703 at crystal diode CR1701 to obtain the two required af signals. As a result of the mixing action in the diode, seven frequencies are present in the stage. These frequencies are the bfo output (452.5 kc), mark frequency (455 kc $+\Delta f$), space frequency (455 kc $-\Delta f$), two sum frequencies (approximately 907 and 908 kc), and two difference frequencies (approximately 2 and 3 kc). However, only the two difference frequencies are in the audio range. The lower frequency signal, approximately 2 kc, is the space frequency and the higher frequency signal, approximately 3 kc, is the mark frequency. The RC filter network composed of R1703, C1703, and C1704 presents a high impedance to the two audio frequencies and a low impedance to the five radio frequencies. Consequently, the radio frequencies are bypassed to ground through C1703 and C1704. Audio frequency space and mark voltages developed across load resistor R1704 are coupled through C1709 to the grid of audio amplifier V1704.

The mark and space signals are amplified in V1704, which is a conventional pentode amplifier, and applied to primary windings of Z1701, the discriminator transformer assembly.

(*d*) BEAT FREQUENCY OSCILLATOR STAGE V1703 (26A6). *(See figure 2–46.)* — Bfo stage V1703 is a modified electron-coupled Pierce oscillator having an output of 452.5 kc. Crystal Y1701 is the main frequency determining component. Feedback to sustain oscillations is coupled from the oscillator anode element (screen grid) to the grid circuit through C1707. The oscillator output is taken from the plate of V1703 and coupled through C1708 to detector CR1701, for mixing with the 455 kc $\pm\Delta f$ mark and space signals.

(*e*) DISCRIMINATOR Z1701 AND VOLTAGE DOUBLER-RECTIFIER CIRCUIT. *(See figures 2–47 and 2–48.)* — The audio frequency mark and space signals are applied to the primary of discriminator transformer assembly Z1701. The discriminator consists of two separate transformers in a single case, with their primaries connected in series. Inductance of winding 5, 6 and capacitance of C1713, C1727 present a low impedance to the lower frequency space signal. Inductance of winding 3, 4 and capacitance of C1712, C1726 present a low impedance to the higher frequency mark signal. A voltage doubler-rectifier network is connected across each secondary winding, and the two networks are connected to the input circuit of dc amplifier Q1701.

The voltage divider-rectifier networks function as follows: A space signal from af amplifier V1704 is coupled to secondary winding 5, 6 of Z1701. (See figure 2–46.) During the half-cycles, when terminal 5 of Z1701 is positive, electron current will flow from terminal 6 through CR1704 and C1717 to terminal 5, charging C1717 to the supply (signal) voltage with the polarity shown in figure 2–47. During the half-cycles that terminal 6 of Z1701 is positive, electron current will flow from terminal 5 through C1719 and CR1705 to terminal 6, charging C1719 to the supply (signal) voltage with the polarity shown in figure 2–47. The capacitances of C1717 and C1719 are large enough so that they retain their charges between half-cycles. Therefore, as the two capacitors are in series, the voltage across C1717 and C1719 is double the signal voltage. Also, because of the rectifying action of CR1704 and CR1705, the space signals will produce positive pulses at the base of dc amplifier Q1701.

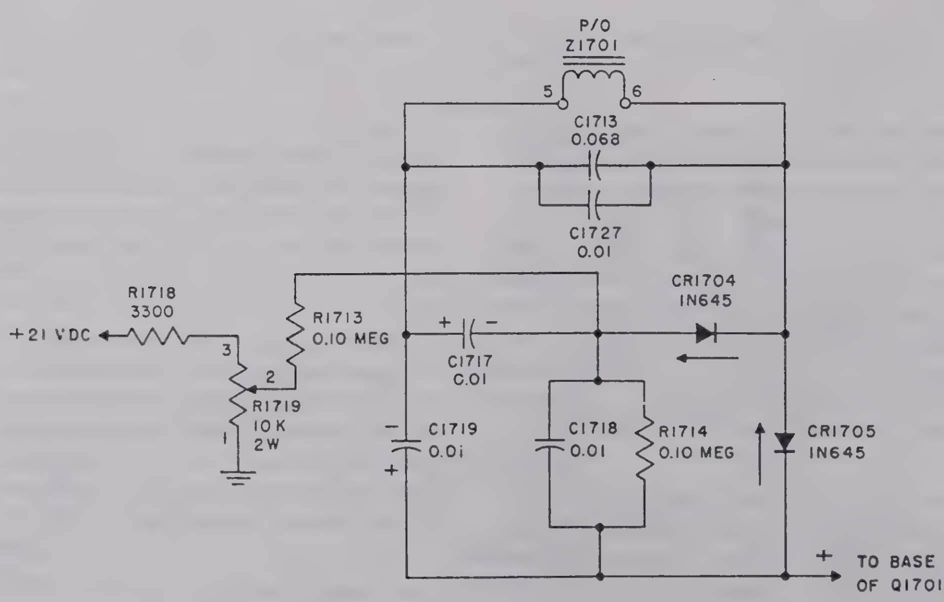


Figure 2–47. AF Discriminator and Space Signal Voltage Doubler-Rectifier Network, Simplified Schematic

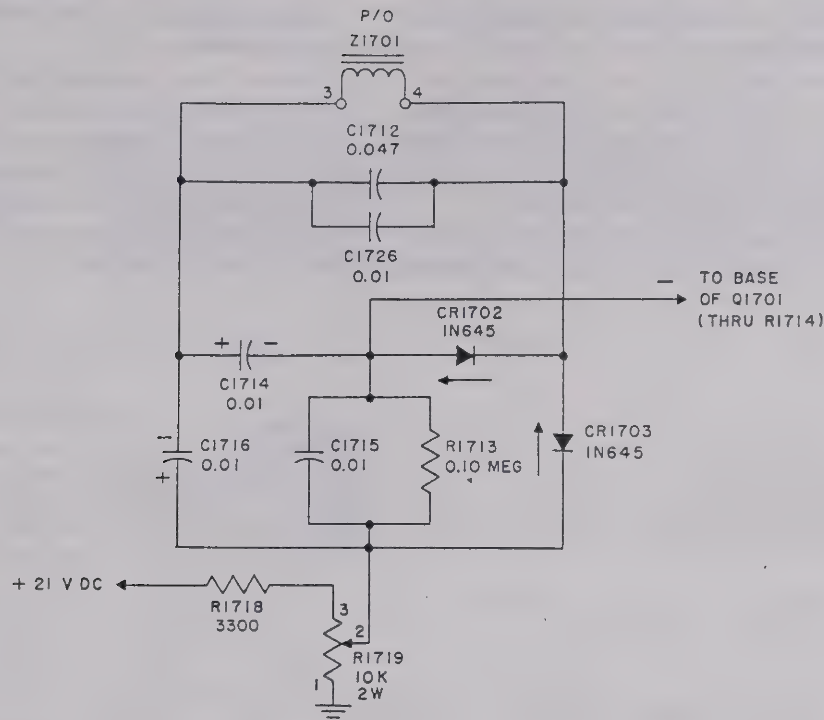


Figure 2-48. Discriminator and Mark Signal Voltage Doubler-Rectifier Network, Simplified Schematic

The mark network (see figure 2-48) operates in a manner similar to the space network, except that the negative end of C1714, C1716 in series goes to the moveable arm of R1719. The negative mark signals are applied to the base of Q1701 through R1714.

The input pulses to Q1701 operate at a positive bias level determined by the setting of voltage divider R1718, R1719.

RC filter networks C1715, R1713 and C1718, R1714 smooth out any ripple that may be present in the voltage doubler-rectifier circuit.

(*f*) DC AMPLIFIER Q1701 AND Q1702 (2N340). *(See figure 2-49.)* — Dc amplifier stage Q1701 and Q1702 controls the operation of keying relay K1701. Relay K1701 is a dual-coil, latching-type relay used to operate a polar or neutral teletypewriter. Both Q1701 and Q1702 are NPN junction type transistors.

Coil 1, 8 of K1701 will energize when Q1702 conduction is sufficient. When this occurs, the resistance of Q1702, in series with coil 1, 8, is less than the impedance of R1725, in series with coil 2, 3. Thus, contacts 6 and 4 will open and 6 and 7 will close. When Q1702 conduction is low, its resistance will be higher than R1725, and coil 2, 3 will have control of the relay, as it is energized to the plate supply line.

A positive bias voltage is applied to the base of Q1701 from a voltage divider comprised of R1718 and potentiometer R1719. Q1701 emitter current through R1724 biases Q1702 in its forward direction, allowing it to conduct. R1719 is adjusted to the point where, with no mark or space input, the Q1702 current produces a collector voltage equal to the voltage drop across R1725. Since the TELETYPE TUNING meter is connected between R1725 and the Q1702 collector, these equal potentials will produce a center scale (zero) reading on the meter. The arm (6) of K1701 will remain latched to either contact 4 or 7.

During the space intervals, the positive pulses applied to Q1701 drive the transistor to heavy conduction. The increased emitter current through R1724 increases the forward bias at the Q1702 collector and Q1702 conducts heavily, energizing coil 1, 8 of K1701. As a result, contacts 6 and 7 close, the teletypewriter is sent to the space position, and the TELETYPE TUNING meter deflects from zero because of the unequal potentials at the meter connections.

A negative mark pulse applied to the base of Q1701 causes a decrease in the bias current at Q1702, causing the resistance of Q1702 to increase to a valve greater than R1725. Thus coil 2, 3 controls the relay causing contacts 6 and 4 to close and sending the teletypewriter to the mark position. Since the potential at the Q1702 collector is more positive than the potential at the top of R1725, the meter deflects to the opposite side of zero. If the receiver is correctly tuned, mark and space signals will cause the meter to fluctuate equally and have an average value of zero.

R1722, C1728 and R1723, C1729 are used to suppress arcing at the contacts of K1701.

As stated in paragraph 2–6*e*, the connections to the teletypewriter can be reversed with the front panel NORMAL-REVERSE switch.

(2) FS CONVERTER, IF. TYPE. *(See figure 2–50 and 7–88.)* — The if. type converter is a removable plug-in subassembly. Plate voltage is applied to the unit only when OPERATION SWITCH S1502 is at the CW, FSK BROAD and FSK PHONE positions.

Frequency shift transmissions, shifted at an audio rate about the 455-kc if. frequency, from V1603 in the if. subassembly, are amplified and demodulated to operate a keying relay which is connected to an external teletypewriter.

Figure 2–51 illustrates the waveforms produced during the conversion process.

(*a*) IF. AMPLIFIER STAGE V1751 (26A6). *(See figure 2–52.)* — The output signal of the third if. amplifier, V1603, at the mark frequency of 455 kc $+\Delta f$ and the space frequency of 455 kc $-\Delta f$, is applied to the control grid of V1751, a conventional pentode

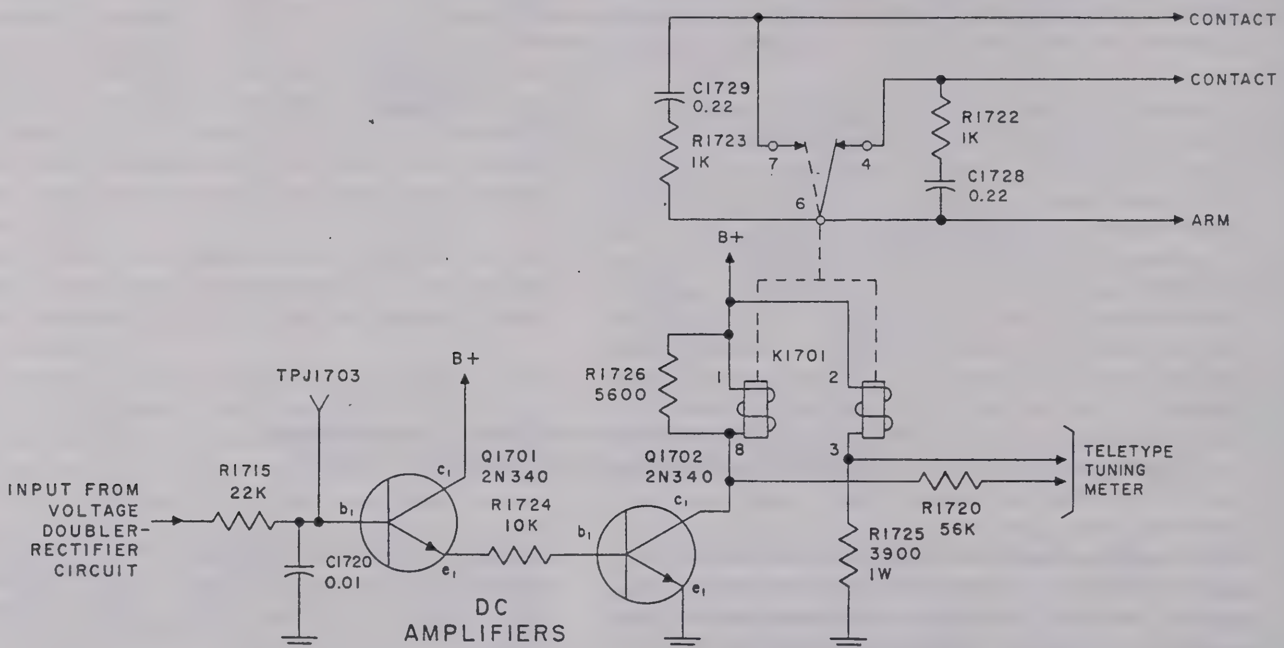


Figure 2–49. FS Converter AF Type, Stage Q1701, Q1702, Simplified Schematic

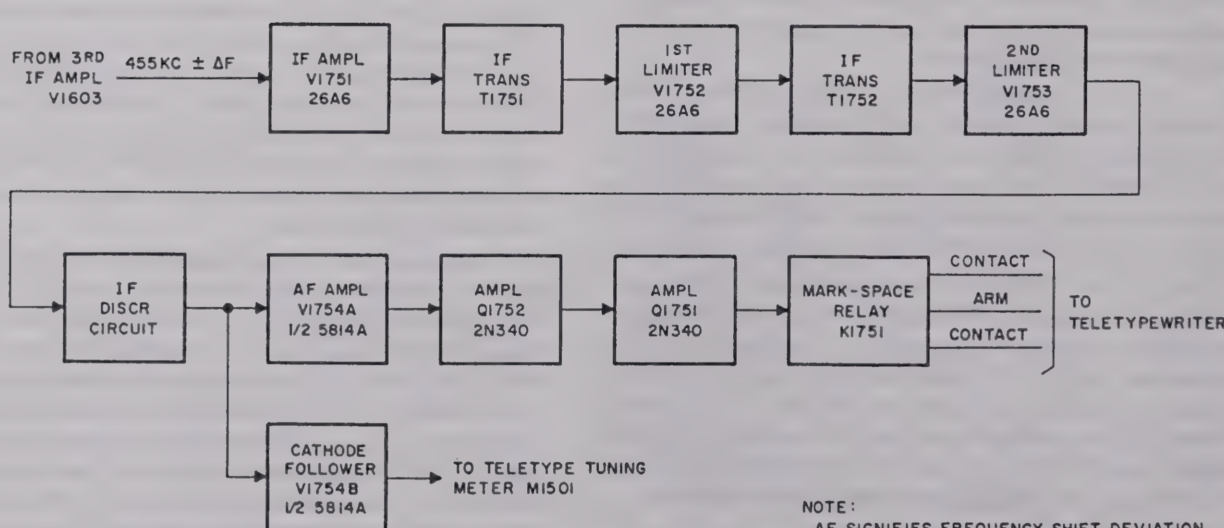


Figure 2–50. FS Converter, IF. Type, Block Diagram

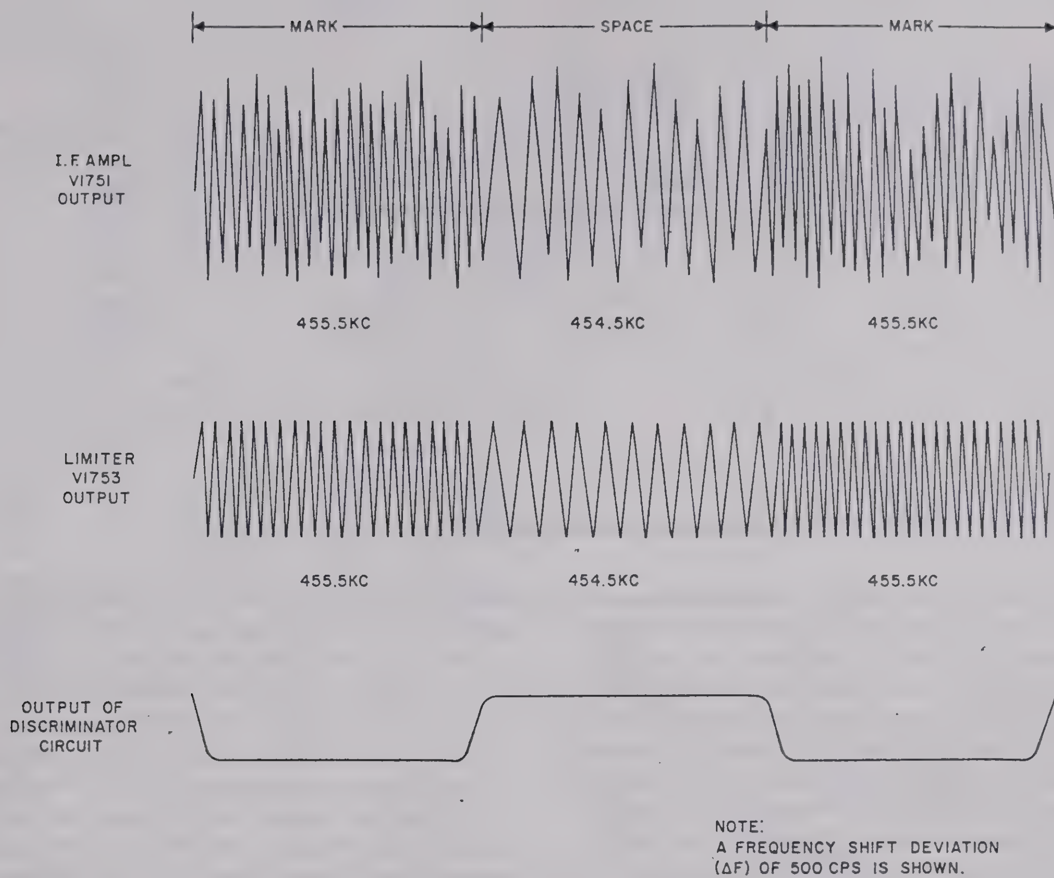


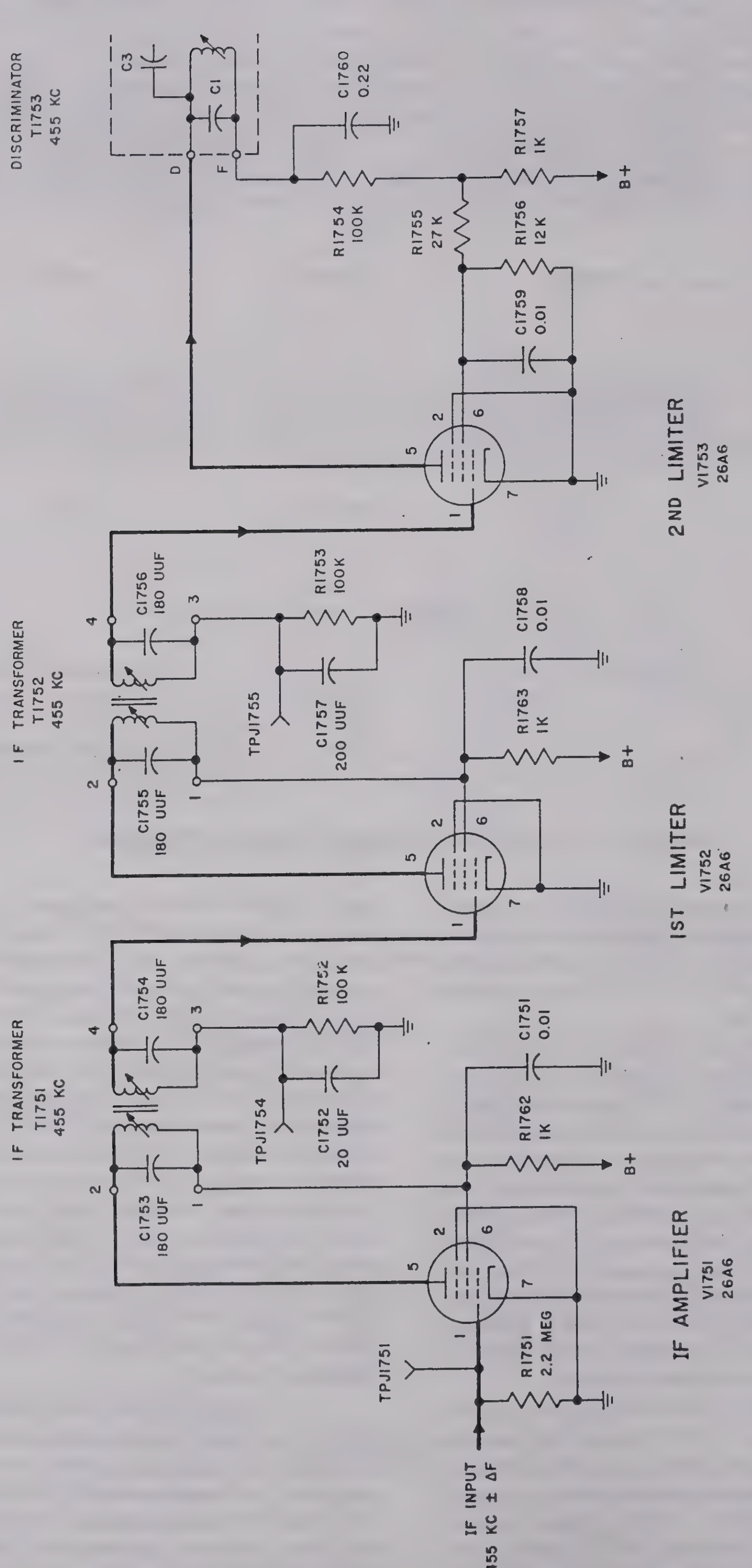
Figure 2-51. FS Converter, IF. Type, Theoretical Waveforms

amplifier used to provide the gain required for proper operation of the limiter stages. Output of the tube is coupled through if. transformer T1751 to the control grid of first limiter tube V1752. T1752 is a bandpass transformer tuned to 455 kc.

(*b*) FIRST LIMITER STAGE V1752 (26A6) AND SECOND LIMITER V1753 (26A6). *(See figure 2-52.)* — Tubes V1752 and V1753 provide negative and positive limiting respectively of the output from if. amplifier V1751. Since the space and mark signals are actually a form of frequency modulation, the limiters remove noise peaks and other amplitude variations without affecting the intelligence of the incoming signal. The discriminator circuit used in the converter is quite sensitive to amplitude variations. Therefore, two limiter stages are used to obtain sufficient clipping of any amplitude variations, thereby providing a steady-level input to the discriminator.

Output from if. amplifier V1751 is applied to the control grid of first limiter V1752. During the positive peaks of the input signal the plate is driven to saturation, grid current will flow and, consequently, a charge will be developed on C1752. During negative half-cycles, C1752 discharges through R1752 thereby developing a grid-leak bias for the tube. This bias will adjust itself to be slightly less than the level of the positive peak value of the signal. Since the RC time constant of the R1752-C1752 combination is approximately equal to the period of the 455-kc signal, most of the positive half-cycle will be amplified, but the portion of the signal below the grid cutoff voltage will be limited. Because of this unsymmetrical limiting action, a second limiter is used. The phase inverted signal at the plate of V1752 is coupled across T1752 to the control grid of second limiter V1753. This stage operates a similar manner as V1752 but, because of the phase reversal through V1752, the unlimited portion of the incoming signal is acted upon. However, since the rf time constant at the V1753 grid is approximately ten times the period of the 455-kc signal, amplification of the positive portion of the signal is restricted and a fairly symmetrical signal is produced at the plate of V1753. The output from V1753 is applied to a discriminator circuit.

(*c*) DISCRIMINATOR CIRCUIT. *(See figure 2-53.)* — A Foster-Seeley discriminator circuit is used to detect the mark and space pulses. This circuit is comprised of transformer T1753, silicon diodes CR1751, CR1752 and associated components. R1758 and R1759 are the load resistors for CR1751 and CR1752, respectively. The dc electron flow path of each diode is such that the voltage drop across R1758 is negative



NOTE:
ΔF SIGNIFIES FREQUENCY SHIFT DEVIATION.

Figure 2–52. FS Converter, IF. Type, Stages V1751, V1752, V1753, Simplified Schematic

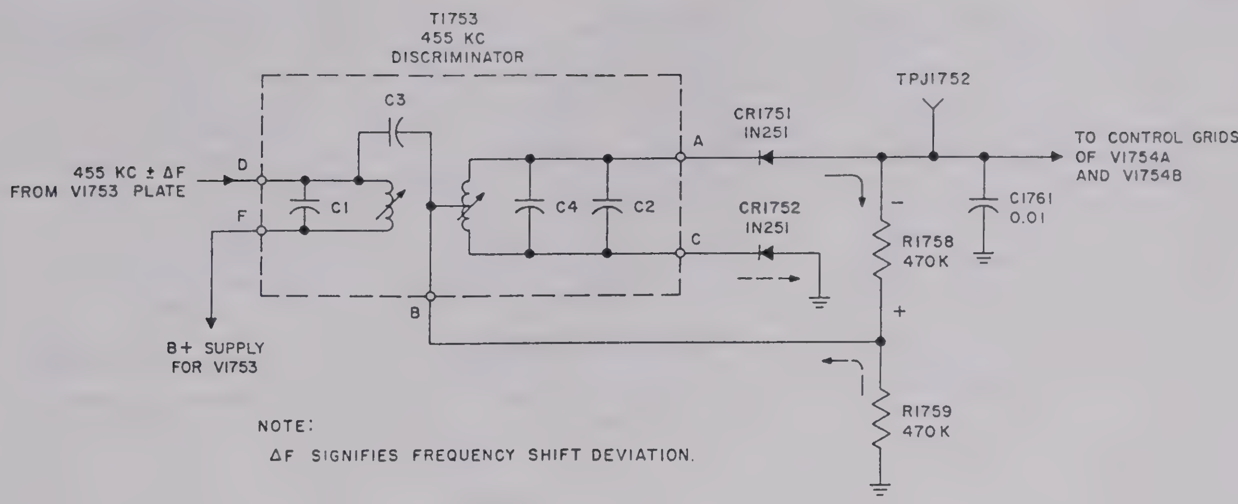


Figure 2–53. IF. Type Discriminator Circuit, Simplified Schematic

and the voltage drop across R1759 is positive with respect to ground. (In this manual, the bar of the diode is considered to be the cathode and the arrowhead is the anode. Electron current flow then is from the bar to the arrowhead. See figure 2–5.)

The primary and secondary windings of discriminator transformer T1753 are tuned to the 455-kc if. frequency. In addition to the transformer coupling, signal voltage from the primary is coupled via C3 (part of T1753 assembly) to a tap on the secondary winding. The principle of detecting the frequency shifted mark and space signals is based on the fact that the capacitive-coupled voltage is out-of-phase with the transformer-coupled voltage.

Consider the case where a non-shifted transmission is being received and the signal is at the if. frequency of 455 kc. The signal which is coupled by C3 is used as the reference voltage. (See figure 2–54.) The transformer-coupled voltage at the T1753 secondary (E_{sec}) is 180 degrees out of phase with the primary reference voltage (E3). At resonance (455 kc), the reactive voltage theoretically is purely resistive and the reactive voltage drop across the secondary is divided into equal and opposite polarity voltages (E1 and E2) (figure 2–54, A.) Since the capacitive-coupled signal (E3) is applied to the secondary tap, the two reactive voltages are each 90 degrees out of phase with the reference signal. The voltages are added vectorially to produce resultant voltages $E1_A$ and $E2_A$. Voltages $E1_A$ and $E2_A$ are applied to the cathodes of CR1752 and CR1751, respectively. Since $E1_A$ and $E2_A$ are equal, the voltage drops across R1758 and R1759 will likewise be equal, but of opposite polarity. As a result the two voltages will cancel and there will be a net zero voltage output from the discriminator circuit.

When a mark signal of 455 kc $+\Delta f$ is applied to tuned transformer T1753, the secondary presents an inductive reactance to the transformer-coupled voltage. See figure 2–54, B. The induced secondary voltage (E_{sec}) and current (I_{sec}) are no longer in phase and the secondary current lags the secondary induced voltage. The reactive voltages E1 and E2 are always displaced 90 degrees from the secondary current. Since the capacitively coupled reference voltage (E3) remains at 0 degrees, a frequency shift deviation above 455 kc (mark) causes one half of the reactive voltage (E2) to be less than 90 degrees, and the other half (E1) to be greater than 90 degrees, with respective to the reference voltage. The resultant vector addition causes $E2_A$ to be greater than $E1_A$. This causes CR1751 to conduct more than CR1752 and thus the negative voltage developed across R1758 will be greater than the positive voltage developed across R1759. As a result, the discriminator produces a negative pulse output each time a mark is received.

When the if. signal swings below 455 kc (space) the tuned secondary of T1753 presents a capacitive reactance to the incoming signal. Conditions are reversed from that described above and a positive pulse output is produced. See figure 2–54, C.

The plus and minus output pulses from the discriminator, occuring at the audio frequency keying rate, are fed to the control grids of af amplifier V1754A and cathode follower V1754B. C1761 is an rf bypass capacitor in the output circuit of the discriminator.

(*d*) AF AMPLIFIER V1754A (1/2 5814A) AND CATHODE-FOLLOWER V1754B (1/2 5814A). *(See figure 2–55.)* — The negative and positive mark and space pulses from the discriminator, occurring at an audio rate (Δf), are fed to the control grids of af amplifier V1754A and cathode follower V1754B. The amplified, phase inverted output from the plate of V1754A is coupled through C1763 to the base of Q1752. Cathode follower V1754B provides isolation for TELETYPE TUNING meter M1501 to prevent it from loading down the discriminator circuit.

One terminal of M1501 is connected to the cathode of V1754B while the other terminal is connected to the

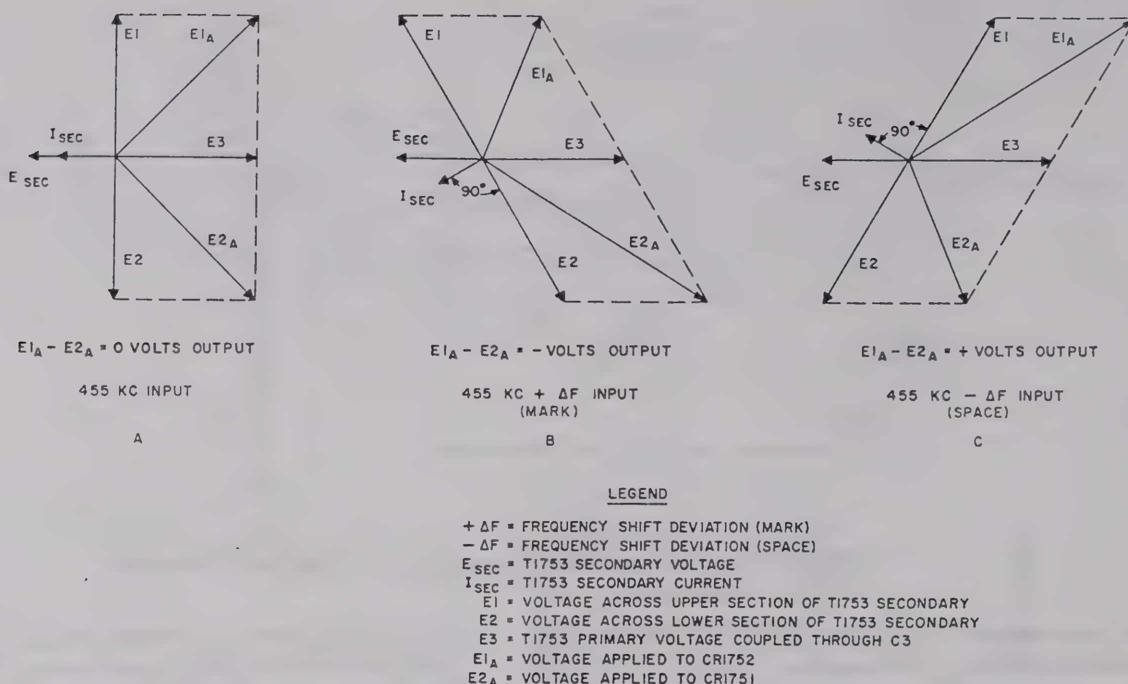


Figure 2–54. IF. Type Discriminator Circuit, Operating Characteristics

wiper of potentiometer R1769. Resistors R1768, R1769, and R1770 comprise a voltage divider connected across the +26.5-volt supply. R1769 is a balance adjustment. With no input to the receiver, R1769 is adjusted to obtain an equal potential between the cathode of V1754B and the wiper of R1769. Thus, the TELETYPE TUNING meter has a center scale (zero) reading with no input applied. As a result, the meter will deflect to either side of zero when a frequency shifted transmission is received. If the receiver is correctly tuned, the meter will fluctuate equally and have an average value of zero.

(*e*) AMPLIFIER STAGES Q1752 (2N340) AND Q1751 (2N340). *(See figure 2–55.)* — The space and mark pulses from V1754A are further amplified by Q1752 and coupled through C1769 to the base of Q1751. Transistor stage Q1751 controls the operation of teletype keying relay K1751, a dual coil, latching-type relay used to operate a polar or neutral teletypewriter.

Coil 1, 8 of K1751 is connected in series with Q1751 across the +21-volt supply bus; coil 2, 3 of K1751 is connected in series with R1775 across the +21 volt bus. When Q1751 conduction is low, its resistance is higher than R1775. Thus more current will flow through coil 2, 3 and that section will have control of the relay, causing contacts 6 and 4 to close. When Q1751 conduction is sufficient, its resistance will be less than R1775, and coil 1, 8 will control the relay, closing contacts 6 and 7.

Because of the phase inversion by Q1752, the input to Q1751 consists of positive space and negative mark pulses. A positive bias voltage is applied to the base of Q1751 from the wiper of potentiometer R1779. R1779 is adjusted to provide sufficient Q1751 collector current to close contacts 6 and 7 of K1751 with positive space input pulses applied to Q1751. A negative mark pulse applied to the base of Q1751 causes collector current to decrease, causing the transistor resistance to increase to a value greater than R1775. Thus coil 2, 3 controls the relay, causing contacts 6 and 4 to close and sending the teletypewriter to the mark position.

R1764, C1765 and R1765, C1766 are used to suppress arcing at the K1751 contacts.

As stated in paragraph 2–6*e*, the connections to the teletypewriter can be reversed with the front panel NORMAL-REVERSE switch.

2–7. RADIO SET CONTROL GROUP OA–1444/GRC–14.

Theory of operation of the control group is presented to provide an understanding of how the units comprising the control group are interrelated with each other and with the operations of Radio Set AN/MRC–55.

The control group provides keying, talking and listening facilities for the radio set to a remote point, by means of a telephone line. It also provides telephone communication and ringing between local remote control and field remote control. The extension of power control (dynamotor) of the radio set to local remote and field remote controls is another function of the control group.

Theory discussion in the following paragraphs is based on the overall schematic diagrams for local remote control (figure 7–90) and field remote control

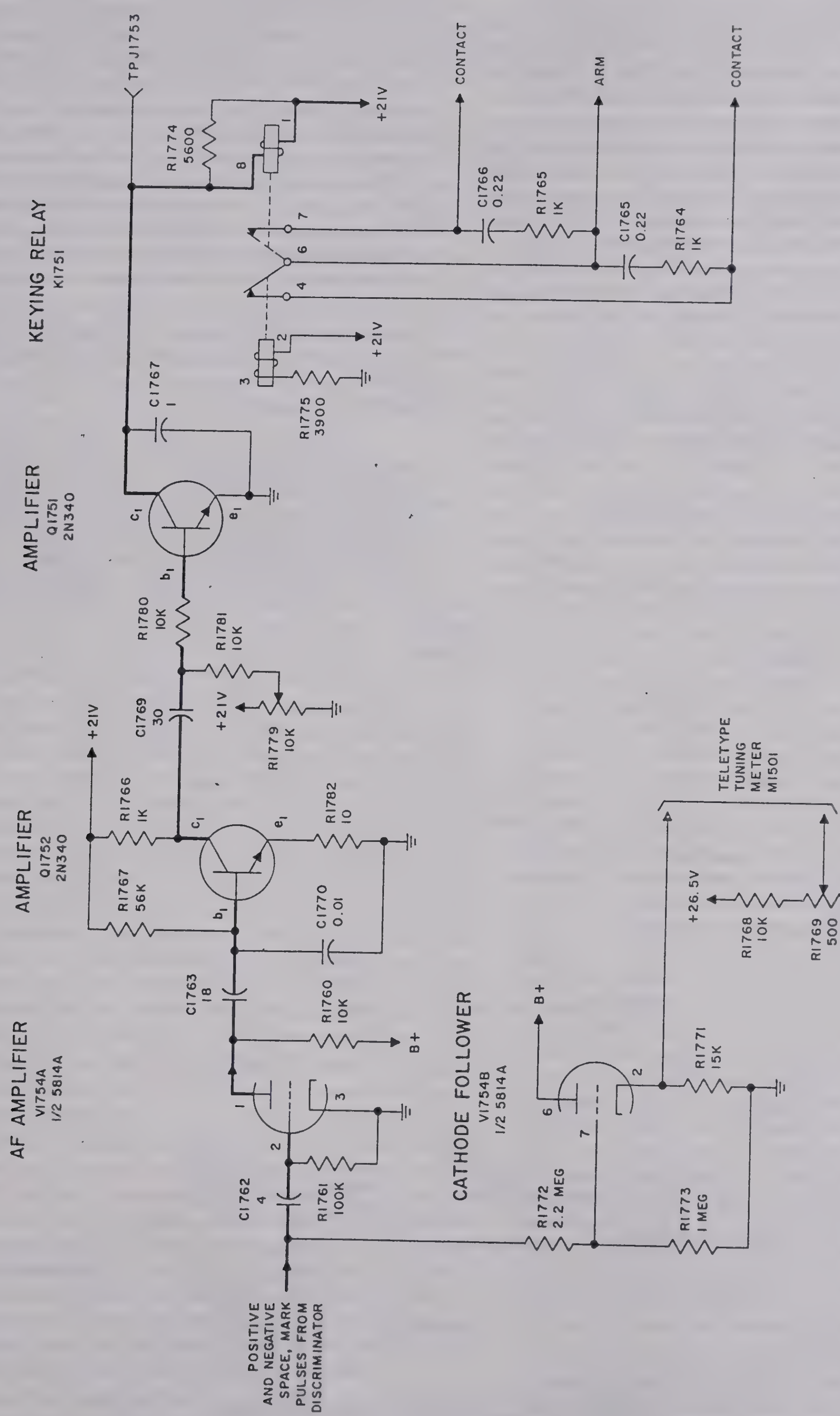


Figure 2-55. FS Converter, IF Type, Stages V1754A, V1754B, Q1752, Q1751, Simplified Schematic

(figure 7–92), and the control group block diagram (see figure 2–56).

a. RADIO SET CONTROL C–2171/GRC–14. — Local remote control provides a local terminal for field remote control, in addition to push-to-talk control of the transmitter from a remote point in the vehicle.

(1) INTERPHONE CIRCUIT. — Each of the two control units provides a line transformer (T1901 and T2001) with microphone input, receiver output, and balanced 600-ohm line windings. The transformers joined by the telephone line constitute the basic telephone circuit. With microphones and phones connected to the respective windings of the two transformers and with the dry cells installed in each of the two units, two-way telephone communication between the two control units is made possible.

A duplex telephone circuit is set up when local remote control OPERATION switch S1902 and SERVICE switch S1903 are in the TEL position and field remote control SERVICE switch S2001 is in TEL position. The control voltage of 45 volts dc, supplied by battery BT2003 in the field remote control, and control relays K1901, K1902, and K1903 in the local remote control are disconnected from the line during interphone service. Terminals 2, 3 and 4 of switch S1902, section 1, rear, connect the local remote control microphone to the microphone supply of 3 volts dc, supplied by batteries BT1901 and BT1902. The microphone supply, in turn, is connected in series with the microphone winding 5–6 of line transformer T1901. The microphone circuit is completed by closing the push-to-talk switch on the handset. Voice frequency currents developed across windings 5–6 of T1901 are induced in windings 1–2 and 3–4 of T1901, which are joined by dc blocking and audio bypass capacitor C1901B, selected by terminals 5 and 8 of switch S1903, section 1, rear. This signal is applied to the telephone line binding posts L1 and L2. A portion of the voice signal is developed across phone winding 7–9 of T1901 and returned to the sender's phone as sidetone.

Voice frequency currents received from the field remote control are induced in winding 7–9 of T1901 and applied to the operator's phone. Winding 7–9 of T1901 is returned to ground through terminals 12 and 9 of S1903, section 1, rear.

(2) RINGING CIRCUIT. — Ringer G1901 is a hand-operated ringer which, when cranked, disconnects local bell DS1902 or indicator lamp DS1901, by opening contacts 2 and 3 of G1901, and connects the magneto-type generator (contacts 1 and 3) which is normally disconnected from the circuit. A 20-cycle voltage is generated, passed through each half of

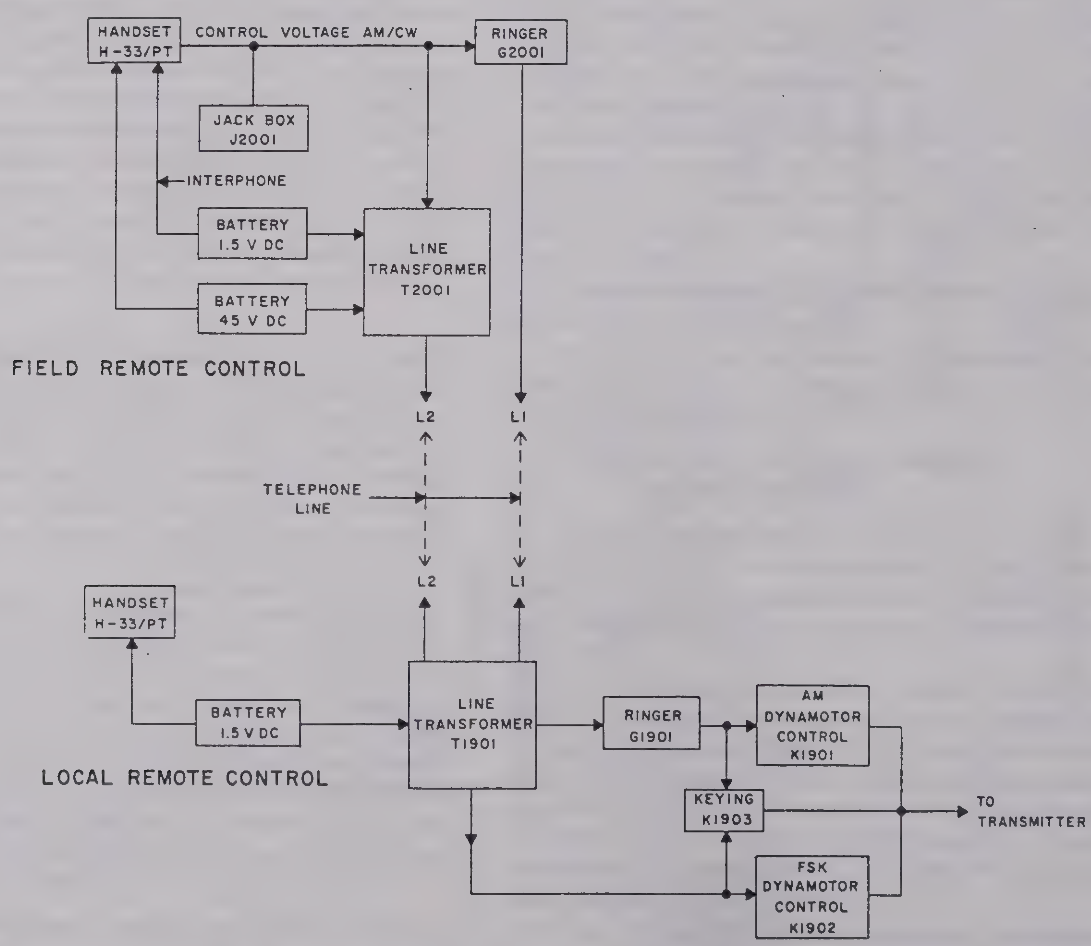


Figure 2–56. Control Group, Block Diagram

windings 1–2 and 3–4 of T1901, and is transmitted over the line to the field remote control. Ringing signals developed across winding 3–4 of T1901 induce a signal across phone winding 7–9 of T1901 and, therefore, can be heard in the headphones of both operators.

The 20-cycle ringing signal is received from the field remote control in the same way as audio signals. This signal passes through the line windings of T1901, through terminals 3 and 2 of generator G1901, and is applied either to a bell or to an indicator lamp, depending on the position of internal LAMP-BELL switch S1901. When switch S1901 is in the BELL position, the bell is connected into the circuit through blocking capacitor C1910A, across dc blocking capacitor C1901B and between terminals 2 and 3 of T1901. With switch S1901 in the LAMP position, the lamp is in series with voltage-dropping resistor R1901 and is connected across the same points in the line circuits as bell DS1902.

(3) AM. CIRCUIT. — The function of turning on the push-to-talk am. circuit is placed under a relay control circuit in the transmitter. Normally, contacts of the relay circuits keep the receiver operative, while the transmitter is in an inoperative condition. When the relay control circuit is energized, the receiver is disabled and the transmitter is turned on. To permit control of this function from a remote control position, the ground return lead for the relay circuits is brought out through a panel connector to local remote control.

When OPERATION switch S1902 is in LOCAL position, and SERVICE switch S1903 is in AM position, the push-to-talk switch on the handset turns the dynamotor on and off. Dynamotor control is accomplished by completing the ground return circuit through the push-to-talk switch, terminals 7 and 8 of switch S1903, section 2, rear, and terminals 1 and 4 of S1902, section 2, rear, and terminal F of P1901 (carrier control) to the transmitter.

In addition, the push-to-talk switch also completes the am. circuit between the microphone and the transmitter. The microphone push-to-talk circuit is connected to the microphone output, terminal C of P1901, which mates with J1305 of the transmitter.

When switch S1902 is in REMOTE position, it transfers control of the dynamotor and transmitter to field remote control.

The receiver audio output, terminal A of P1901, is connected through terminals 5, 7 and 8 of switch S1902, section 2, rear, to the local phone.

(4) MONITORING. — With field remote control in control of the transmitter during am. or cw/fsk operation (S1902 in the REMOTE position and S1903 in AM or CW/FSK position), the local remote control operator may listen to the field operator only during listening periods (key up or push-to-talk switch off), but can talk to the field operator at any time.

When the local remote control unit has control of the transmitter (S1902 in LOCAL position and S1903 in AM position), the field remote control operator cannot hear the local operator, but can talk to him.

This break-in operation by the local remote or field remote operator will not affect transmitter operation.

The field remote operator may be monitored in am. or cw operation from the phone jacks on the transmitter front panel. This is accomplished through the receiver audio output circuit (terminal A of P1901).

b. RADIO SET CONTROL, C–2172/GRC–14. — The field remote control provides the means for controlling the radio set in am. phone and cw keying operation over a two-wire, 600-ohm telephone line up to one mile in length. Telephone operation with ringing facilities between the field remote and local remote operators is also provided. Control of the dynamotor is accomplished from field remote control by means of the push-to-talk switch on the handset. When used with a separate teletype system (fsk), the field remote control is used to turn the dynamotor on and off.

(1) CONTROL CIRCUIT. — Control facilities of field remote control consist of SERVICE selector switch S2002, and a control voltage of 45 volts dc supplied by battery BT2003. The field operator can disconnect the 45-volt battery from the line in TEL (interphone) operation; connect the battery across the line so that L1 is positive and L2 is negative (cw/fsk operation); or connect the battery across the line so that L1 is negative and L2 is positive (am. operation). Connection of the battery across the line is completed by the push-to-talk switch in am. operation, and key-down position during cw/fsk operation. Three control relays located in the local remote control are part of the control circuit for the field remote control. Relay K1901 is the dynamotor control relay in am operation, K1902 (latching relay) controls the dynamotor during cw/fsk operation, and K1903 is the keying relay.

(2) INTERPHONE CIRCUIT.—When SERVICE selector switch S2002 is placed in TEL (interphone) position, terminals 3, 4 and 7, 8 of S2002 disconnect battery BT2003 (45V) from the circuit. Microphone supply batteries, BT2001 (1.5-volt dc) and BT2002 (1.5-volt dc), are connected in series through the push-to-talk switch of Handset H–33/PT to the microphone winding (terminals 5–6) of line transformer T2001. The microphone circuit is not affected by switch positions of S2002 and is only disconnected by releasing the push-to-talk switch. Voice frequency currents developed across winding 5–6 of T2001 are induced in windings 1–2 and 3–4 of T2001. The dc blocking and audio bypass capacitor C2001B, selected by terminals 10, 11 and 12 of switch S2002, connects both windings of T2001 (1–2 and 3–4) in series. This signal is applied to the telephone line through binding posts L1 and L2.

Voice frequency currents received from the local remote controls are induced in winding 7–9 of T2001 and applied to the phones. For a more complete discussion of the duplex telephone circuit, refer to the

interphone circuit of local remote control, paragraph 2–7*a*(1).

Jack box J2001 accommodates two additional headsets, connected in parallel across phone winding (7–9) of T2001, and an additional microphone, connected to the microphone winding terminal 6 (through BT2001 and BT2002) and to terminal 5 of T2001.

(3) RINGING CIRCUIT. — Refer to paragraph 7*a*(2) for a discussion on the theory of operation of the ringing circuit for local remote control. This circuit is identical to the ringing circuit in the field remote control.

(4) AM. CIRCUIT. — With SERVICE selector switch S2002 in the AM position, the positive terminal of BT2003 (45-volt dc) is connected to telephone line L2 through terminals 4 and 2 of switch S2002, current limiting resistor R2002, and winding 3–4 of line transformer T2001. The negative side of BT2003 is connected to line L1 through terminals 8 and 6 of S2002, the push-to-talk switch of the handset, terminals F and H of connector J2002, contacts 2 and 3 of ringer G2001, and winding 1–2 of T2001. Closing the push-to-talk switch completes the circuit and places the 45-volt dc control voltage on the telephone line.

Control relay K1901, located in the local remote control, figure 7–90, is energized by the control voltage. One set of contacts (8 and 5) controls the dynamotor; another set of contacts (6 and 7) transfers the voice signals to the transmitter through terminals 7 and 8 of S1902, section 1, rear. Switch S1902 must be in REMOTE position, and switch S1903 must be in AM position.

During push-to-talk am. transmission, voice frequency currents are developed across microphone winding 5–6 of T2001 and induced in windings 1–2 and 3–4 of T2001. This signal is applied to the telephone line through binding posts L1 and L2. Sidetone is induced in the field operator's headset, through winding 7–9 of T2001, by the generated voice currents.

Voice currents enter local remote control through L1 and L2, developed across windings 1–2 and 3–4 of T1901, and are induced in windings 5–6 and 7–9 of T1901. The voice signals are taken from winding 5–6 of T1901 and connected to the microphone output (terminal C of P1901) through terminals 6 and 7 of relay K1901, capacitor C1903, and terminals 7 and 8 of switch S1902.

Turning the dynamotor on and off is accomplished by means of the push-to-talk switch which completes the control voltage circuit and causes relay K1901, located in the local remote control, to be energized. Contacts 5 and 8 of K1901 close the ground return circuit to the dynamotor control, through terminals 3 and 4 of switch S1903, section 2, rear (AM), and terminals 3 and 4 of switch S1902, section 2, rear (REMOTE) to terminal F of P1901.

During listening periods, voice signals from the radio receiver are brought into the local remote control through terminal A of P1901, terminals 5, 7 and 8 of S1902, section 2, rear (LOCAL or REMOTE), and developed across winding 7–9 of T1901. The signals are induced in windings 1–2 and 3–4 of T1901 and applied to the telephone lines through L1 and L2. The audio signals enter field remote control, are developed in the primary windings, induced in the secondary windings of T2001, and applied to the phones from phone winding 7–9 of T2001.

(5) CW KEYING CIRCUIT. — During cw keying at field remote control, SERVICE selector switch S2002 is placed in the CW position. The negative terminal of BT2003 (45-volt dc) is connected to line L2 through switch S2002, current limiting resistor R2002, and winding 3–4 of transformer T2001. The positive terminal of BT2003 is connected to line L1 through switch S2002 the push-to-talk switch, contacts 2 and 3 of ringer G2001, and winding 1–2 of T2001. Switching S2002 from am. to cw operation reverses the polarity of battery BT2003 being applied to lines L1 and L2. Note that the telephone line must be polarized for proper cw operation, because local remote control contains a polarized latching relay K1902 which will latch closed with the first pulse of the telegraph key. Closing contacts 4–6 of K1902 turns on the dynamotor by completing the circuit of the ground return through terminals 2 and 4 of S1903 section 2, rear (CW/FSK), and terminals 3 and 4 of S1902, section 2, rear (REMOTE). The dynamotor will remain on until the field operator reverses the polarity of the control voltage to unlatch relay K1902. This is done by switching S2002 to the AM position and pressing the key once. Momentarily depressing FSK switch S2003 on the field remote control front panel will also latch or unlatch relay K1902, depending on the position of S2002 (CW or AM).

Closing the key in field remote control completes the control voltage circuit to the L1 side of the line. Relay K1903 is a high-speed sensitive keying relay located in local remote control. It is energized by the control voltage and follows the keying at field remote control. In the de-energized position (key-up), the armature terminals 5, 6 (ground) of relay K1903 are connected to contact 4a disconnect position. In the energized position (key down), ground is connected to the cw key control of the transmitter through contacts 5, 6 and 7 of K1903, terminals 11 and 12 of S1902, section 1, rear, and terminal K of P1901.

(6) FSK (TELETYPE) OPERATION. — When a separate teletype (fsk) system is connected to the transmitter by means of a separate loop, field remote control can be used to turn the dynamotor on and off by reversing the polarity of battery BT2003 with switch S2002 (CW and AM), and depressing momentary FSK switch S2003 to complete the circuit.

(7) MONITORING. — When local remote control has control of the transmitter during am. operation (S1902 in LOCAL and S1903 in AM position), the field remote control operator cannot hear the local operator, but can talk to him at any time.

adjusted to obtain maximum modulation without distortion.

If the % MOD control has been indiscriminately moved and its setting is doubtful, set the TEST meter selector switch to the % MOD position, talk into a microphone plugged into the front panel and adjust the % MOD control for a reading of 1 on the TEST meter. Then arrange for a radio check with another radio set and adjust the % MOD control for maximum modulation without distortion.

Lock the % MOD control upon completing the adjustment.

4-3. RADIO RECEIVER.

a. INTRODUCTION. — Before operating the receiver for the first time determine that all installation connections and adjustments have been made in accordance with section 3. Figure 4-2 and table 4-2 show the locations and functions of the controls used in operating the receiver. The receiver is continuously tunable through its 2 to 32-mc range.

The two receivers used as components of Radio Set AN/MRC-55 are identical. One is usually set on an operational frequency, while the other is in a standby status. For purposes of explanation, the receiver using

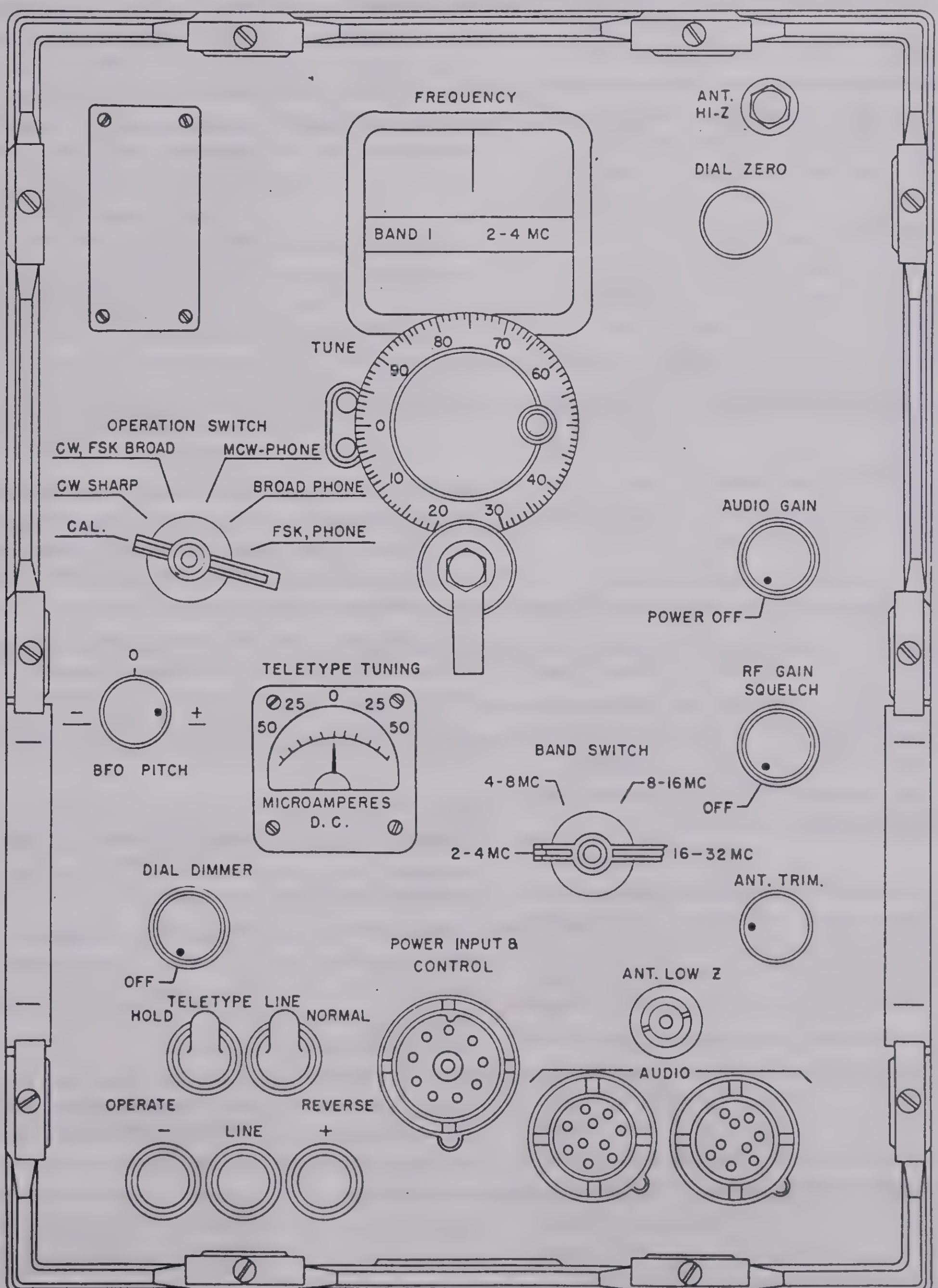


Figure 4-2. Radio Receiver, Front Panel

TABLE 4–2. RECEIVER CONTROLS AND INDICATORS

REFERENCE SYMBOL	PANEL OR CHASSIS MARKING	DESCRIPTION	FUNCTION
S1503	POWER OFF	DPST rotary switch; part of R1532.	Applies input power to receiver.
R1532	AUDIO GAIN	0 to 500,000 ohm, 1-watt, variable resistor.	Adjusts gain of receiver audio stages.
S1504	DIAL DIMMER	SPST rotary switch; part of R1530.	Applies power to dial lights.
R1530		0 to 500-ohm, 2-watt variable resistor.	Adjusts brilliance of dial lights.
S1502	OPERATION SWITCH	4-section, 1-pole, 6-position rotary switch.	Sets receiver for desired type of reception. (Refer to table 4–3 for detailed description of each switch position.)
R1531	RF GAIN SQUELCH	0 to 250-ohm, 1-watt variable resistor.	Adjusts gain of rf stages for operation on all positions of OPERATION SWITCH except PHONE position. (Rf gain in PHONE position is controlled by an agc voltage.) Adjusts squelch level when OPERATION SWITCH is at PHONE position. In PHONE position and when the RF GAIN SQUELCH control is in its extreme counterclockwise position (OFF), the squelch circuit is disabled.
M1501	TELETYPE TUNING	0 to 50-μa dc meter, center-zero type.	Monitors amplitude of fs converter mark and space pulses. Used to tune receiver for fsk reception.
S1501	BAND SWITCH	11-section, 4-position rotary switch.	Sets input stages of receiver for reception on any one of 4 frequency ranges: 2 to 4 mc, 4 to 8 mc, 8 to 16 mc, and 16 to 32 mc.
C1501	TUNE	5-section variable air-dielectric capacitor; 0 to 230.75-$\mu\mu$f each section.	Tunes receiver to the operating frequency (main tuning control).
C1506	ANT TRIM	2.6 to 19.7-$\mu\mu$f variable air-dielectric capacitor.	Compensates for antenna reactance.
C1623	BFO PITCH	2.6 to 19.7-$\mu\mu$f variable air-dielectric capacitor.	Adjusts frequency of audible note heard during cw reception.
	DIAL ZERO	Knob which shifts dial pointer.	Tuning dial calibration.
	FREQUENCY	Steel tape dial.	Indicates frequency to which receiver is tuned.
S1506	HOLD-OPERATE	SPDT, 2-position toggle switch.	HOLD position prevents noise from keying teletypewriter when tuning receiver; also, prevents teletypewriter from "running away".
S1507	NORMAL-REVERSE	DPDT, 2-position toggle switch.	Permits reversal of mark and space inputs to teletypewriter to compensate for double conversion on bands 3 and 4, and/or differences in transmitting techniques.

the transmitter antenna will be referred to as receiver 1, while the receiver using an independent antenna will be referred to as receiver 2. Receiver 1 will be automatically disabled whenever the transmitter is keyed. The radio set may be used as a relay station to relay voice transmissions between distant stations automatically. When such a service is being performed, receiver 2 and the transmitter will be set at different frequencies. Receiver 2 will then energize the dynamotor, key the transmitter, and its audio output will modulate the rf carrier wave when a phone transmission is received.

Headphone receptacles are provided on the transmitter front panel and on the field remote control. In addition, two multi-conductor audio receptacles are provided on the receiver front panel to allow for loudspeaker reception, additional headphones and handset operation of the radio set. The front panel illumination lamp has an on-off switch and an adjustable brilliance control to enable the operator to maintain blackout conditions.

There are two methods for accurately calibrating the main tuning dial. The dial has calibration marks inscribed at 200-kc intervals which are used in conjunction with an internal calibration oscillator and a movable fiducial pointer to align the dial. The receiver may also be set on frequency by zero-beating it to the transmitter when the SERVICE switch is set at the NETTING position.

b. CAPABILITIES AND LIMITATIONS. — The receiver can receive cw, fsk, mcw, and phone transmissions in the 2 to 32-mc frequency range. Simultaneous reception of fsk and phone transmissions is also possible. It can be tuned continuously throughout its range in four bands, each band having a one per cent frequency overlap. The receiver incorporates a frequency-shift converter to allow for polar or neutral keying of Teletypewriter Set AN/TGC–6, which may be located a maximum distance of one mile from the radio set.

Input to the receiver is from a single-ended whip antenna or a long-wire antenna. An antenna trimmer control is mounted on the front panel. An antenna transfer relay (located in the transmitter) transfers the common antenna from receiver 1 to the transmitter when the transmitter is keyed. The receivers also have a break-in relay which grounds the input to the receiver when the transmitter is keyed (except during RELAY operation). The receiver is capable of delivering 150 milliwatts of audio power into 600-ohm output accessories, such as handsets, headsets, and loudspeakers, with a maximum of 10 per cent total distortion. A squelch circuit and an agc voltage are provided for phone reception.

The two receivers use a common audio output line. In order to prevent audio interference between the two receivers, the gain of one receiver should be reduced if the receivers are tuned to different frequencies. The normal procedure is to have one receiver operative and the second available as a standby unit. The second receiver should be tuned either to the operating frequency whereby it can be used as a back-up unit, or it can be tuned to a separate "guard" or listening frequency.

c. OPERATIONAL CONTROLS AND INDICATORS. — All controls and indicators necessary to operate the receiver are mounted on the front panel, with the exception of the POWER SELECTOR switch. This primary power switch, located on the power supply, must be either at the AC or DC position when operating the receivers. Refer to figure 4–2 and table 4–2 for the locations and functions of the operational controls.

d. OPERATING PROCEDURES. — There are two methods which may be used to tune the receiver, both of which are outlined in this paragraph.

(1) PREFERRED RECEIVER TUNING PROCEDURE. — The following steps outline the preferred method:

Step 1. Place the POWER SELECTOR switch on the power supply front panel at the DC position if the vehicle is being used as an input power source, or in the AC position if an external 115-volt ac source is being used.

Step 2. Insert a headset into a phone receptacle on the transmitter if a loudspeaker is not connected to the receiver.

Step 3. Place the OPERATION SWITCH at the CAL. position.

Step 4. Place the BFO PITCH control at zero.

Step 5. Place the BAND SWITCH at the position which covers the frequency desired.

Step 6. Rotate the AUDIO GAIN control to its full clockwise position. This control is part of the power switch and will apply power to the receiver when it is rotated from its POWER OFF position.

Step 7. Rotate the RF GAIN SQUELCH control to obtain a suitable noise level.

Step 8. Set the DIAL DIMMER control to the desired illumination.

Step 9. Rotate the main tuning control until the desired frequency lies under the fiducial pointer. Then rotate the control towards the nearest calibration mark. An audio signal should be heard as the calibration mark approaches the fiducial pointer.

Step 10. Adjust the main tuning control for a zero beat as heard in the headset or loudspeaker. If the calibration mark does not coincide with the pointer, adjust the DIAL ZERO control until the pointer is positioned directly over the calibration mark.

Step 11. Place the OPERATION SWITCH at the desired service. Refer to table 4–3 for an explanation of the switch positions.

Step 12. Rotate the main tuning control until the desired frequency is positioned directly under the fiducial pointer on the FREQUENCY dial.

Note

If the receiver is being tuned to an fsk transmission, the operator should observe the TELETYPE TUNING meter. If the receiver is tuned correctly, the needle will swing an equal amount either side of zero. If it does not, adjust the main tuning control slightly to equalize the swings.

Step 13. When operating at the BROAD PHONE position of the OPERATION SWITCH, set the RF GAIN SQUELCH control at its fully clockwise position (minimum squelch) and adjust the ANT TRIM control for maximum receiver noise. Then rotate the RF GAIN SQUELCH control in a counterclockwise direction to the point where receiver noise just disappears.

Note

In setting the squelch level, exercise extreme care at all times so that weak signals will not be lost. The squelch level should ordinarily be the point at which noise just becomes inaudible under the conditions of no-signal input. Further silencing entails the danger of squelching weak signals which might be desirable to hear. On the other hand, restraint in the use of silencing in the hope of picking up weak signals, will be useless because signals which do not exceed the noise level will be untelligible. The squelch circuit can be disabled by placing the RF GAIN SQUELCH control to its extreme counterclockwise (OFF) position.

CAUTION

When Radio Set AN/MRC–55 is used as an automatic relay station (NORMAL-REMOTE-RELAY switch on the transmitter at the RELAY position), care must be taken not to over-squelch. If such a condition occurs, the transmitter will be automatically energized.

Set the AUDIO GAIN control to obtain a suitable audio level.

Step 14. For reception of cw transmissions, rotate the BFO PITCH control clockwise or counterclockwise from its zero position and continue to step 15.

Step 15. When operating at the CW SHARP; CW, FSK BROAD; MCW-PHONE; and FSK, PHONE positions of the OPERATION SWITCH, set the AUDIO GAIN control at its fully clockwise position. Adjust the RF GAIN SQUELCH control to obtain a low level of noise and then adjust the ANT TRIM control for maximum receiver noise.

Step 16. For reception of cw and mcw transmissions, set the RF GAIN SQUELCH control to obtain the desired audio level of the received signals. For reception of fsk transmissions, turn the RF GAIN SQUELCH control to its OFF position (fully counterclockwise).

Step 17. For reception of cw transmission, rotate the BFO PITCH control until the desired audio note is heard in the headset or loudspeaker.

(2) ALTERNATE RECEIVER TUNING PROCEDURE. — When the transmitter and receiver are to be operated on the same frequency, an alternate method of setting the receiver frequency is possible. The following steps outline this method: (The transmitter must be properly tuned on frequency before using this method.)

Step 1. Place the POWER SELECTOR switch on the power supply front panel at the DC position if the vehicle is being used as an input power source, or in the AC position if an external 115-volt ac source is being used.

Step 2. Insert a headset into a phone receptacle if a loudspeaker is not connected to the receiver.

TABLE 4–3. FUNCTIONAL DESCRIPTION OF OPERATION SWITCH

POSITION	PURPOSE
CAL.	Energizes a 200-kc oscillator for use in calibrating FREQUENCY dial; applies plate power to the BFO.
CW SHARP	Allows for reception of unmodulated carrier wave transmissions. Provides for good selectivity by narrowing receiver bandwidth. Energizes a beat frequency oscillator; limits the if. bandwidth to 3.5 ±0.5 kc at the 6-db points, and switches in an audio filter, which has a center frequency of 1000 cycles and a bandwidth of 350 cycles at the 6-db points. No agc voltage is applied at this position.
CW, FSK BROAD	Allows for reception of unmodulated carrier wave transmissions and frequency shift keying transmissions. Energizes a beat frequency oscillator and the fs converter. No agc voltage is applied at this position.
MCW-PHONE	Allows for reception of modulated carrier wave transmissions. No agc voltage is applied at this position.
BROAD PHONE	Allows for reception of voice transmissions. An agc voltage is applied at this position but there is no manual control of rf gain. A squelch circuit can be used at this position for silent receiver operation. The PHONE position is used whenever the AN/MRC–55 is used as a relay station.
FSK, PHONE	Allows for simultaneous reception of frequency-shift keying and voice transmissions. Energizes the fs converter. No agc voltage is applied at this position.

Step 3. Place the SERVICE switch on the transmitter to the NETTING position.

Step 4. Place the OPERATION SWITCH to any position except the CAL. or PHONE positions.

Step 5. Set the BFO PITCH control to zero.

Step 6. Rotate the AUDIO GAIN control to its fully clockwise position. This control is part of the power switch and will apply power to the receiver when it is rotated from its POWER OFF position.

Step 7. Rotate the RF GAIN SQUELCH control to obtain a suitable noise level.

Step 8. Set the DIAL DIMMER control to the desired illumination.

Step 9. Place the BAND SWITCH at the position which covers the frequency desired.

Step 10. Rotate the main tuning control towards the desired frequency. An audible beat note should be heard as the frequency is being approached. Adjust the main tuning control for a zero beat as heard in the headset or loudspeaker.

Step 11. Place the SERVICE switch on the transmitter to the desired service.

Follow the procedure outlined in steps 11 through 17 of the preferred method of tuning the receiver.

(3) FSK OPERATION. — In addition to the controls described in the preceding subparagraphs, the operator may also be required to use the HOLD-OPERATE and NORMAL-REVERSE switches.

The HOLD-OPERATE switch should be set to HOLD when the receiver is being tuned to prevent random operation of the teletypewriter.

The NORMAL-REVERSE switch should be operated as needed. If normal reception is taking place, but the teletypewriter is printing incorrectly (garbled), change the position of the NORMAL-REVERSE switch. The position of this switch will usually have to be changed when the receiver tuning is changed from bands 1 or 2 to bands 3 or 4.

4–4. POWER SUPPLY.

a. INTRODUCTION.—Before operating the power supply for the first time, determine that all installation connections and adjustments have been made in accordance with section 3. Radio Set AN/MRC–55 is capable of performing various duplex and simplex teletype functions. Section 3 outlines the various interconnections necessary for teletype operation.

There are only three operating controls in the power supply frame. The POWER SELECTOR switch, the main power switch, is located on the front panel. There are also two switches for teletype operation which are located inside the cabinet. Figures 4–3, 4–4 and table 4–4 indicate the locations and functions of the controls used in setting up the power supply.

The power supply also has a meter mounted on its front panel which indicates the hours of dynamotor operation.

The air vents for the blower motor have front panel covers which must be closed prior to submerging the radio set.

b. CAPABILITIES AND LIMITATIONS. — All input power to the radio set enters the power supply frame. Input power to the power supply is +26.5 volts dc and 24 volts ac when the vehicular generator is used as the prime power source, and 115-volts ac when an external source of power is used.

The power supply furnishes +26.5 volts, −105 volts, +250 volts (regulated), 312 volts (approx.), and +1100 volts for transmitter operation. It also furnishes +115 volts dc to operate a teletypewriter motor and a +115-volt dc teletype loop supply. The receivers have their own internal power supplies.

c. OPERATING PROCEDURES. — In order to operate Radio Set AN/MRC–55, the POWER SELECTOR switch should be set at the DC position if the vehicular generator system is to be used, or at the AC position if an external source is to be used to supply input power. This is the only control necessary for oven, standby, am, netting, and cw operation.

If teletype operation is desired, it will be necessary to set the KEYING switch and LOOP SUPPLY switch correctly. It will be necessary to withdraw the power supply from its cabinet to gain access to these switches. (Refer to figure 4–4 for their location.)

The KEYING switch is set at POLAR if polar keying service is desired and at NEUTRAL if that type of keying is used. The LOOP SUPPLY switch is set at EXTERNAL if the teletype set has its own source of loop supply current and at LOCAL if the power supply is used to supply loop current.

4–5. REMOTE CONTROL OPERATING PROCEDURES.

This paragraph describes the procedures for operating Radio Set AN/MRC–55 from local remote control and field remote control. Local remote control is operated in the vehicle containing the transmitter and receiver, and field remote control may be operated from a distance of one mile from the vehicle. (Refer to figures 4–5 through 4–8 and tables 4–5 and 4–6, for locations and functions of the operating controls.)

a. LOCAL REMOTE CONTROL OPERATING PROCEDURES. — The transmitter and the receiver must have power applied to them, be set on frequency, and tuned prior to operation from local remote control. In addition, the following steps must be performed:

Step 1. Place the NORMAL-REMOTE-RELAY switch on the transmitter to the REMOTE position.

Step 2. Set the SERVICE switch on the transmitter to the AM position.

Step 3. Set the OPERATION SWITCH on the receiver to the PHONE position. (If only a listening service is required at the control set, the OPERATION SWITCH may be placed at any position except CAL.)

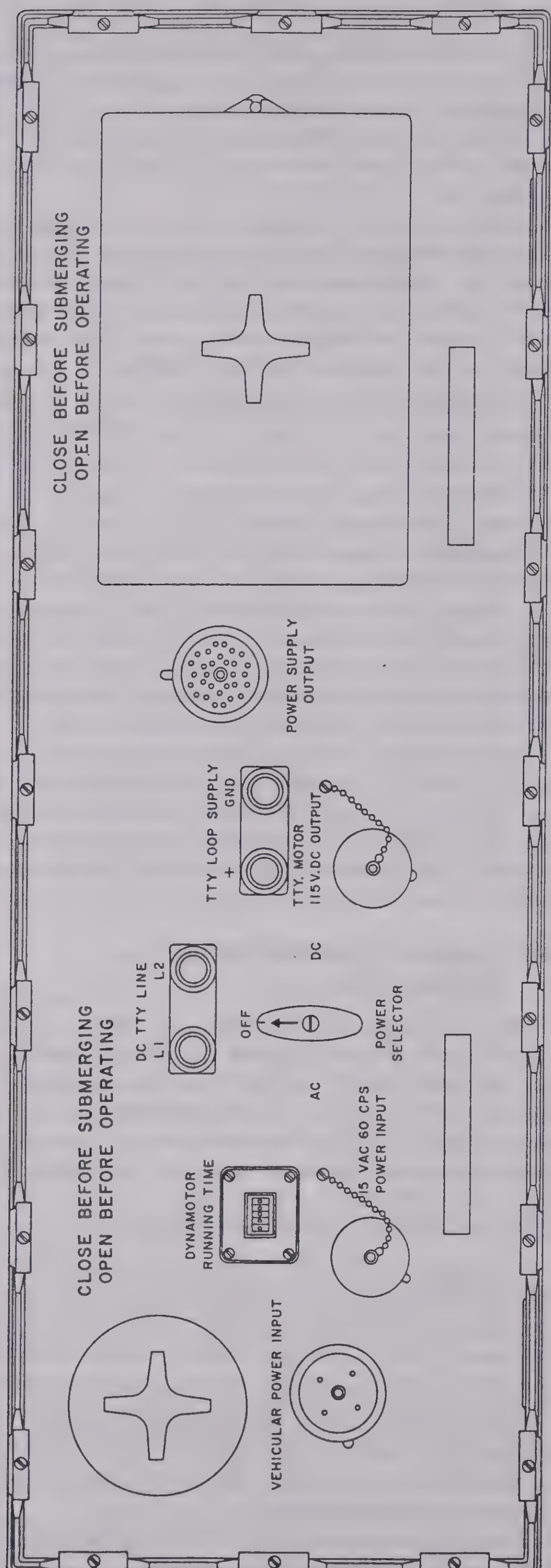


Figure 4–3. Power Supply, Front Panel

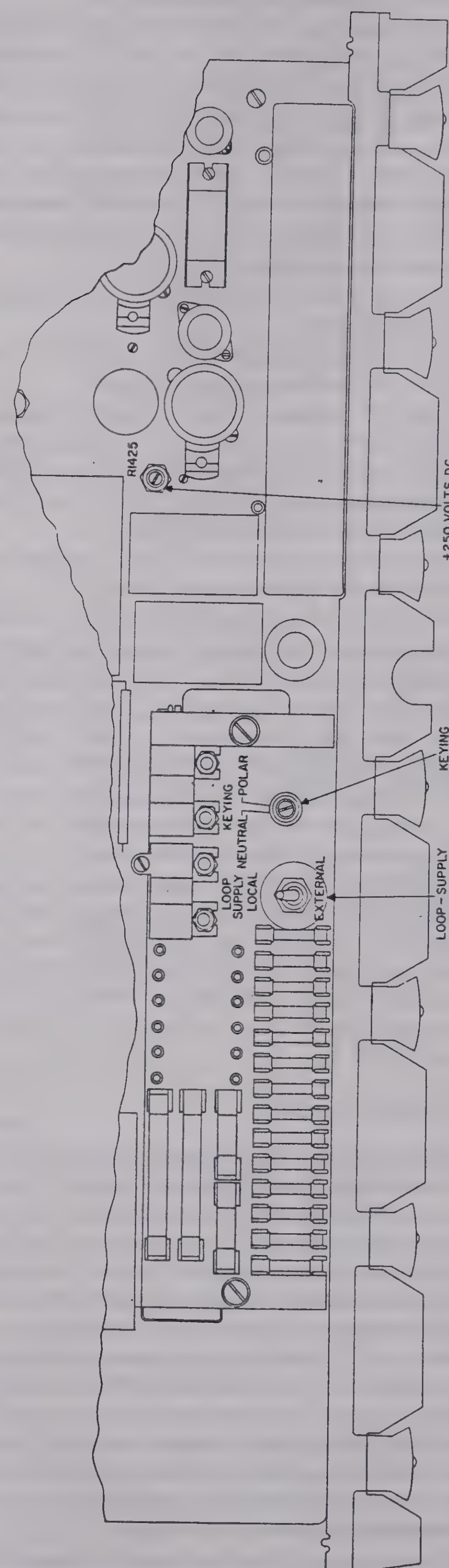


Figure 4–4. Power Supply, Partial Top View

TABLE 4–4. POWER SUPPLY CONTROLS AND INDICATORS

REFERENCE SYMBOL	PANEL OR CHASSIS MARKING	DESCRIPTION	FUNCTION
S1403	LOOP SUPPLY	SPDT, 2-position toggle switch.	Selects either the power supply or the teletype set as the source of loop current.
S1405	KEYING	1-section, 3-pole, 2-position rotary switch.	Polar-netural keying selector.
S1401	POWER SELECTOR	2-section rotary switch: section A composed of 2 poles, 3 positions; section B composed of 5 poles, 3 positions.	Main power control switch.
M1401	DYNAMOTER RUNNING	Time totalizing electric meter, calibrated in hours in 0.1 hr increments; maximum reading of 9999.9 hours; reset type.	Indicates hours of dynamotor service.

Step 4. Place the OPERATION switch on the control set to the LOCAL position.

Step 5. The dynamotor is turned on and the transmitter is keyed by pressing the push-to-talk button on the handset, which allows audio transmission to commence. The receiver output is connected to the handset whenever the transmitter is not keyed.

b. FIELD REMOTE CONTROL OPERATING PROCEDURES. — The transmitter and the receiver must have power applied to them, be set on frequency, and tuned prior to operation from the field remote control. Certain controls on the transmitter, receiver, and local remote control must be set up before operation from field remote control is possible. Instructions to this effect can be sent to vehicle personnel via the interphone. Interphone operation is described in paragraph 4–6.

Proper connection of the pair of telephone wires linking the local remote control with field remote control is important, since terminals L1 and L2 on both units are polarized, and will affect operation of the control group. Proper connection of the telephone wires can be determined by attempting to energize the dynamotor from the field remote control. If this cannot be done, reverse the connections to L1 and L2. A second method is by means of a voltmeter connected across terminals L1 and L2 on the local remote control and reading the control voltage (+45 volts or —45 volts) on L1 and L2 depending on the positions of the SERVICE and OPERATION switches on both units, as follows:

Step 1. Place OPERATION switch on the local remote control to REMOTE position.

Step 2. Place the SERVICE switches on both units to CW/FSK (local remote control) and CW (field remote control), and depress the FSK switch on the field remote control, to energize the circuit.

Step 3. With the positive probe of voltmeter connected to L1 and the negative probe connected to L2 on the local remote control, read +45 volts on the voltmeter. If the needle on the voltmeter deflects to the left and off-scale, reverse the connections of the telephone wires on L1 and L2 of the local remote control.

Step 4. De-energize the circuit by placing the SERVICE switch on the field remote control to AM position and depressing the FSK control at the field remote control, momentarily. This will unlatch the holding relay in the local remote control by reversing the voltage on L1 and L2, as shown below:

OPERATION SWITCH	Terminals (Both Units)	
	L1	L2
AM	—45 volts	+45 volts
CW/FSK	+45 volts	—45 volts

Note

After ensuring proper connection of the telephone wires, operate the radio set from the field remote control as directed in steps 5 through 12.

Step 5. Place the NORMAL-REMOTE-RELAY switch on the transmitter to the REMOTE position.

Step 6. Set the SERVICE switch on the transmitter to the AM, CW, or FSK-AM position, depending on the service desired.

Step 7. Set the OPERATION SWITCH on the receiver to the position corresponding to the type of transmission to be received.

Step 8. Place the OPERATION switch on the local remote control at the REMOTE position.

Step 9. Place the SERVICE switch on the local remote control at the AM position if voice transmissions are desired, or to the CW/FSK position if fsk or cw transmissions are to be sent.

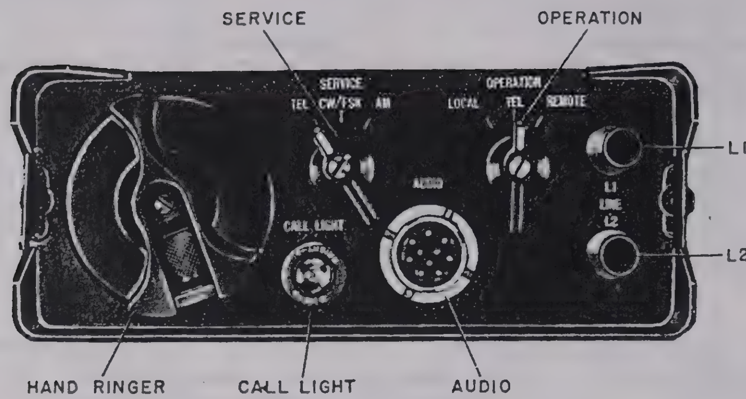


Figure 4–5. Local Remote Control, Front View

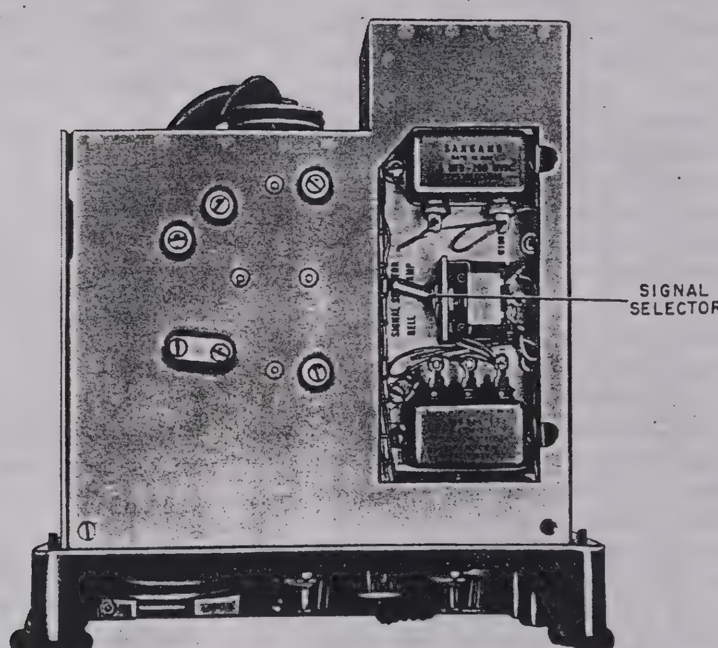


Figure 4–6. Local Remote Control, Top View

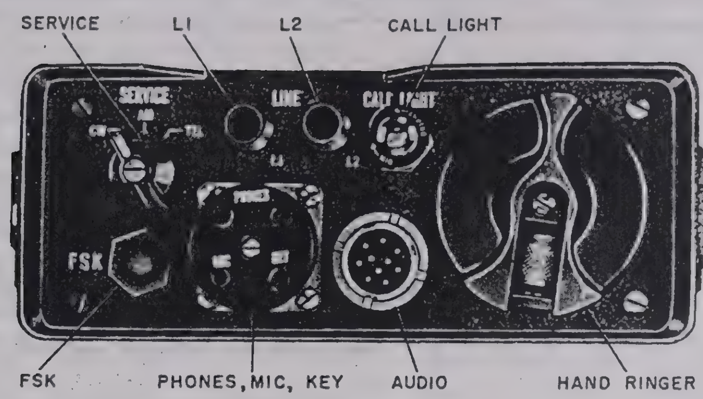


Figure 4-7. Field Remote Control, Front View

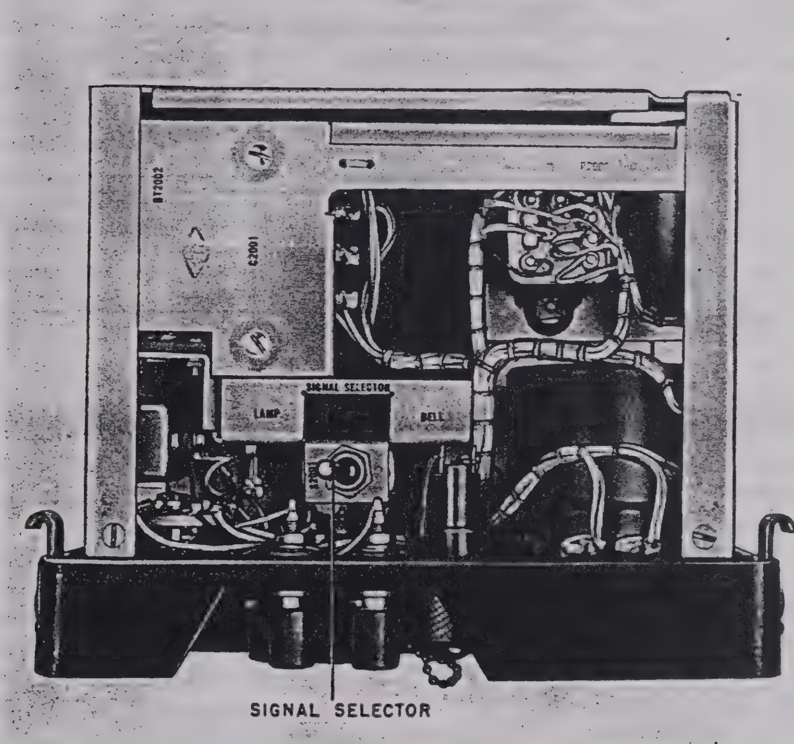


Figure 4-8. Field Remote Control, Top View

Step 10. If voice transmissions are to be sent, place the SERVICE switch on the field remote control to the AM position, press the push-to-talk button on the microphone or handset (which turns on the dynamotor and keys the transmitter), and speak into the microphone. The receiver output can be heard in the handset or headset when the transmitter is not keyed.

Step 11. If cw transmissions are to be sent, place the SERVICE switch at the CW position. To turn on the dynamotor, close the telegraph key once and release, or push the FSK switch. The transmitter will then be ready for operation. To turn off the dynamotor, first place the SERVICE switch on the field remote control at the AM position, then close the telegraph key once and release, or push the FSK switch.

Step 12. If a teletypewriter set at the remote location is connected to the radio set, the operator at the field remote control can control the transmitter. Place the SERVICE switch at the CW position, and push the FSK switch, which turns on the dynamotor. The transmitter will then be ready for operation. To turn off the dynamotor, place the SERVICE switch on the field remote control at the AM position, and push the FSK switch.

TABLE 4–5. LOCAL REMOTE CONTROL, CONTROLS AND INDICATORS

REFERENCE SYMBOL	PANEL OR CHASSIS MARKING	DESCRIPTION	REFERENCE
S1901	LAMP BELL	SPDT, 2-position toggle switch.	Selects a bell or lamp as signal device.
S1902	OPERATION	2-section, 3-pole, 3-position rotary switch.	Switches control of the transmitter between the local and remote control sets; allows for interphone communication.
S1903	SERVICE	2-section, 3-pole, 3-position rotary switch.	Selects the type of transmission to be controlled by the control sets.

TABLE 4–6. FIELD REMOTE CONTROL, CONTROLS AND INDICATORS

REFERENCE SYMBOL	PANEL OR CHASSIS MARKING	DESCRIPTION	FUNCTION
S2001	LAMP BELL	SPDT, 2-position toggle switch.	Selects a bell or lamp as signal device.
S2002	SERVICE	1-section, 3-pole, 3-position rotary switch.	Selects the type of transmission to be controlled by the control set.
S2003	FSK	SPST, momentary action switch.	Energizes or de-energizes a relay whose contacts energize or de-energize the power supply dynamotor by means of a control voltage under control of the SERVICE SWITCH.

4–6. INTERPHONE COMMUNICATIONS.

To allow the operator at field remote control to operate the radio set, provisions have been made for interphone communications between the field site and the vehicle. Using a two-way telephone circuit, the operator in the field can request the operator at the vehicle to set the transmitter controls as required. The field remote control operator sends and receives telephone messages with the handset or with a microphone and headphones. The operator at local remote control uses the handset for communicating between the control sets.

To initiate a telephone conversation, the operator at either control set places his SERVICE switch at the TEL position and turns the hand ringer rapidly a few times. The other operator will either hear a bell ring or notice that the CALL LIGHT is illuminated.

Note

The operators can choose between a bell signal or the call light by placing the LAMP BELL switches in either the BELL or LAMP positions. These switches are located inside the control sets, and can be reached by releasing the front panels and sliding the chassis a few inches forward from the cabinet. (Refer to figures 4–6 and 4–8.)

WARNING

The positions of these switches should be determined before entering a combat area.

The brilliance of the call light can be adjusted by rotating the lamp cover. When the operator at the control set being called hears the bell or notices the call light glowing, he places his SERVICE switch at the TEL position and acknowledges the call.

With field remote control in control of the transmitter (OPERATION switches at the REMOTE positions) during am. or cw/fsk operation, the operator at the local remote control may listen to the field operator only during key-up periods, but can talk to the field operator at any time. When local remote control has control of the transmitter (OPERATION switches at the LOCAL position and SERVICE selector at the AM position), the operator at field remote control cannot hear the local operator, but can talk to him.

The field operator may be monitored in am. or cw operation from the phone jacks on the transmitter front panel and from the loudspeaker.

4–7. SUMMARY OF OPERATING PROCEDURES.

a. STARTING THE EQUIPMENT. — If the equipment is being operated while the vehicle is in motion,

or at locations where no external power source is available, the vehicle generator system must be used as a power source. To energize the radio set, the following steps should be performed.

Step 1. Start the vehicle engine.

Step 2. Place the POWER SELECTOR on the power supply at the DC position.

Step 3. Rotate the AUDIO GAIN control(s) on the receiver(s) clockwise from the POWER OFF position. The receiver(s) will then be ready for operation.

Step 4. Place the SERVICE switch on the transmitter at the OVEN position.

Step 5. The OVENS should be on for at least 10 minutes before commencing transmitter operation. For best stability, the ovens should be left on for one hour prior to operating the transmitter. However, if necessary, full operation can be started 30 seconds after the SERVICE switch is rotated from the OVEN position.

If an external 115-volt 60-cycle ac source is connected to the power supply, the radio set is energized in the same manner except that the vehicle engine does not have to be running, and the POWER SELECTOR on the power supply should be at the AC position.

b. TUNING AND ADJUSTING THE EQUIPMENT. — If the radio set is being energized for the first time, or if a frequency change is required, the transmitter and the receiver(s) should be tuned in accordance with paragraphs 4–2 and 4–3.

c. MODES OF OPERATION. — Choice of cw, am. (phone) or fsk transmission and reception is made with the SERVICE switch on the transmitter front panel and the OPERATION SWITCH on the receiver front panel. The dynamotor will be energized whenever the SERVICE switch is at the NETTING, CW, or FSK–AM positions. The dynamotor is energized, and the transmitter is keyed by the push-to-talk switch on the microphone or handset when operating at the AM position. The transmitter is keyed at the CW position by closing the telegraph key, and at the FSK–AM position whenever the SERVICE switch is at that position. Simultaneous fsk and am. transmissions and receptions are possible when the SERVICE switch is at the FSK–AM position.

d. SHIFTING FREQUENCIES. — The transmitter is continuously tunable to any frequency between 2 and 30 mc, and the receiver can be tuned to any frequency in the 2 to 32-mc range. The various methods of setting up these frequencies are outlined in paragraphs 4–2 and 4–3.

e. SPECIAL FUNCTIONS

(1) RELAY OPERATION. — Radio Set AN/MRC-55 is capable of operation as an automatic relaying station for am. (phone) transmissions. The transmitter and receiver 2 must be set up for am. (phone) operation on different frequencies. In addition, the NORMAL-REMOTE-RELAY switch on the transmitter should be set at the RELAY position. The transmitter should be set up and tuned for am. operation in accordance with paragraph 4–2, and the receiver set up for phone operation in accordance with paragraph 4–3. Special care should be taken while setting the RF GAIN SQUELCH control. When this control is properly set, the received signals will automatically energize the dynamotor (power supply) to permit automatic retransmission.

(2) NETTING. — For netting operation the receiver is tuned to the received signal and the transmitter is tuned to the receiver. The following steps describe this procedure:

Step 1. Tune the receiver for maximum signal strength. (Adjust the gain controls as necessary to facilitate the tuning.)

Step 2. Place the SERVICE switch on the transmitter to the NETTING position.

Step 3. Place the FREQUENCY SET switches on the transmitter to the frequency indicated on the receiver tuning dial.

Step 4. Rotate the VFO ADJ control to the point indicated on the applicable VFO calibration chart for the frequency indicated on the receiver tuning dial. As this point is approached, the SYNCHRONIZATION INDICATOR will deflect to the right or left of zero. Rotate the VFO ADJ control to the center of its lock range.

Step 5. Rotate the 100∼ FREQUENCY SET switch until an audible null is heard on the headset or loudspeaker It may not be possible to obtain an exact zero beat, but adjust the 100∼ control to get as close as possible.

Tune the rf amplifier and rf tuner in accordance with paragraph 4–2.

f. STOPPING THE EQUIPMENT.—To stop transmitter operation, place the SERVICE switch in the STANDBY position if it is anticipated that immediate operation might be required at any time. Otherwise, put the switch in the OVEN position, from which only a 30-second delay is consumed before full operation is possible. Power to the receiver is cut off when the AUDIO GAIN control is rotated to the POWER OFF position. All power to the transmitter and power supply is cut off when the POWER SELECTOR on the power supply is placed at the OFF position. When the radio set is operated from an external 115-volt ac source, the POWER SELECTOR switch, on the power supply front panel, also controls the input power to the receiver.

SECTION 5
OPERATOR'S MAINTENANCE

5-1. INTRODUCTION.

To insure dependable performance and long life of the equipment, it is important that each operator maintain careful supervision of the equipment while on duty.

The operator should be thoroughly familiar with symptoms that would indicate minor defects in the radio set, and should notify authorized maintenance personnel of these defects.

An early report and correction of minor troubles may prevent a major repair of equipment at a later date.

CAUTION

The operator should not attempt any maintenance work without authorization. Inexperienced personnel performing maintenance on the equipment may cause serious equipment damage.

5-2. OPERATOR'S CHECK CHART.

Table 5-1 contains information for the guidance of the operator in performing the required maintenance checks.

5-3. TEST METER.

A TEST meter has been provided on the transmitter front panel for rapid metering of important circuits. The test meter circuit consists of an 11-position rotary switch and a dc milliammeter. Table 5-2 lists the circuits metered, multiplying factor, full-scale ranges, and typical readings.

5-4. FUSE INFORMATION.

The fuses and spares for Radio Transmitter T-631/GRC-14 are located on the left side of Power Supply PP-1711/GRC-14, just inside the front panel. (See figure 5-1.) The fuses and spares for Radio Receiver R-808/GRC-14 are located on the amplifier-power supply subassembly chassis. (See figure 5-2.) There are no fuses in Radio Set Control Group OA-1444/GRC-14.

If any fuse should blow, replace it with one of exactly the same rating. A blown fuse is usually an indication of trouble within the equipment; therefore, a report should be made of all fuses replaced, so that maintenance personnel can make a thorough check of the circuits involved.

CAUTION

Never replace a fuse with one of higher rating unless continued operation of the equipment is more important than probable damage. If a fuse blows immediately after replacement, do not replace it a second time. Call a maintenance technician.

If a fuse has been replaced, and the panel lamp in question still does not light, replace the lamp.

Table 5-3 lists the symptoms that indicate fuse failure in the radio set, and table 5-4 lists the fuse locations, functions and data that will aid in locating the various fuses in the equipment. (Refer to figures 5-1 and 5-2 for fuse locations.)

5-5. TUBES, TRANSISTORS AND DIODES.

a. LOCATION. — Table 5-5 will aid in locating and identifying the tubes, transistors and diodes within the subassemblies of the radio set. The transmitter main chassis and the contact groups contain no electron tubes, transistors or diodes.

b. REMOVAL AND REPLACEMENT. — Removal and replacement is standard except in the case of the three 4X250F, air-cooled tubes in the amplifier-modulator subassembly of the transmitter. Use the following procedure for removing and replacing these tubes:

WARNING

Turn off all power to the transmitter, allow tubes to cool and ground circuit with discharge probe before handling.

Step 1. Remove the three plate clips from the tubes.

Step 2. Loosen and remove the four thumb nuts from the fiberglass tube cover. Remove the cover.

Step 3. Remove the spring clips from each tube.

Step 4. Lift up and remove the porcelain rings.

Step 5. Grasp and lift tube straight up.

Step 6. To replace the tubes, reverse the removal procedure. Be careful not to force the tube; forcing may damage the tube or the socket.

c. ADJUSTMENTS FOLLOWING TUBE OR TRANSISTOR REPLACEMENT.—The following adjustments may be necessary after replacing tubes or transistors in the radio set. See section 7 for adjustment procedures.

(1) TRANSMITTER.

(*a*) AF AMPLIFIER. — If tube V1102 is replaced, potentiometer R1112 may require adjustment.

(*b*) AMPLIFIER-MODULATOR. — If tube V1001, V1002, V1003 or V1004 is replaced, potentiometer R1017 may require adjustment.

(*c*) SERVO CONTROL. — If tube V902 is replaced, potentiometer R908 may require adjustment; if tube V904 is replaced, R924 may require adjustment.

(2) POWER SUPPLY. — If tube V1403 is replaced, potentiometer R1425 may require adjustment.

(3) RECEIVER.

(*a*) FREQUENCY SHIFT CONVERTER (AF-Type). — If transistor Q1701 or Q1702 is replaced, potentiometer R1719 may require adjustment.

(*b*) FREQUENCY SHIFT CONVERTER (IF.-Type). — If tube V1754 is replaced, potentiometer R1769 may require adjustment. If transistors Q1751 or Q1752 is replaced, R1779 may require adjustment.

TABLE 5–1. ROUTINE CHECK CHART

WHAT TO CHECK	HOW TO CHECK	PRECAUTIONS AND REMEDY
Information from previous operator.	Review history in log book and receive oral instructions.	Verify reported abnormal operation.
Over-all operation of the radio set.	Tune transmitter and receiver in accordance with instructions in section 4. Observe and record all meter readings. Compare with normal readings.	Be familiar with operational procedure. Check for inoperative or erratic stage or component. Observe all tubes for abnormal operation. Report abnormal and erratic meter readings.
Important circuits.	Use TEST meter on transmitter front panel. Check against typical readings. (See table 5–2.)	For the regulated +250-volt supply, adjust potentiometer R1425 on top of power supply chassis. (See figure 5-1.) Check DYNAMOTOR RUNNING TIME indicator. Inspect brushes every 100 hours.
Receiver +21-volt dc (regulated) supply.	Use voltmeter to measure voltage on terminal board TB1501, terminal 3, in rf head.	Adjust potentiometer R1564 on amplifier-power supply for +21 volts dc.
Vehicular generator output (+26.5 volts).	Observe voltmeter on vehicle dashboard for abnormal indication.	Check vehicular batteries. Inspect fan belts for proper tension. Report abnormal or erratic voltmeter readings.
Interconnecting cables.	Check that all connections between units are secure.	Report defective cables and connectors.
Operation of relays.	Observe operation of relays.	Report any relays which spark excessively or operate sluggishly.
Panel dial lamps.	Observe panel lamps on all units.	Inoperative lamps may indicate fuse failure. (See table 5-3.)
Meter switch contacts.	Observe meter readings as meter is switched into various circuits.	Report intermittent meter readings immediately.
Remote control units.	Check operation of both remote control units in all modes of operation (AM, CW/FSK and TEL.). Check dynamotor control. Check 1-1/2-volt and 45-volt batteries. Check telephone line.	Report any abnormal operation. Replace defective batteries. Report defective or worn telephone line.
Blowers.	Observe blower operation.	Check both blowers in transmitter and blower in power supply for operation.

TABLE 5-2. TYPICAL TEST METER READINGS

SWITCH POSITIONS	CIRCUITS METERED	TYPICAL READING	FULL SCALE OF METER
OFF	Off		
Erf X3V	Rf input to pa	3.0–4.0 V	±9 V
Ig X10MA	Pa grid current	10–15 MA	30 MA
Ic2 X10MA	Pa screen current	10–15 MA	30 MA
Ik X100MA	Pa cathode current	190–230 MA	300 MA
CONT V X10V	+26.5-volt control supply	+26.5 V	+30 V
BIAS X100V	Bias supply	−105 V	−300 V
+250V X100V	+250-volt supply	+250 V	+300 V
+1KV X1000V	+1100-volt supply	+1100 V	+3000 V
% MOD X1000V	% modulation	1	+3000 V
OFF	Off		

TABLE 5-3. SYMPTOMS OF FUSE FAILURE

FAILURE INDICATIONS	BLOWN FUSE	COMMENTS
RADIO RECEIVER R-808/GRC-14		
One receiver operative, one receiver inoperative.	F1503	Dc operation only.
Dial lamp of inoperative receiver does not light with DIAL DIMMER fully clockwise.	F1504	Ac operation only.
Both receivers inoperative.	F1402	Dc operation only.
Dial lamps do not light with DIAL DIMMER fully clockwise.	F1406	Ac operation only.
RADIO TRANSMITTER T-631/GRC-14		
Transmitter inoperative. Dial lamps do not light with DIAL DIMMER fully clockwise. No readings on TEST meter.	F1401	Ac operation only.
Transmitter dial lamps do not light with DIAL DIMMER fully clockwise. Crystal oven heaters inoperative.	F1403	Ac or dc operation.
Dynamotor will not operate after 30 seconds, when POWER SELECTOR switch is placed in AC or DC position. Rf tuner and amplifier-modulator will not tune (automatic or manual operation). No 26.5-volt dc control voltage as indicated on TEST meter.	F1404	

TABLE 5-3. SYMPTOMS OF FUSE FAILURE (cont)

FAILURE INDICATIONS	BLOWN FUSE	COMMENTS
Transmitter blower motors will not operate. No 26.5-volt dc filament voltage.	F1405	Ac or dc operation.
No output at TTY MOTOR 115 VDC OUTPUT, TTY LOOP SUPPLY and TTY LINE.	F1406 F1412	Ac operation. Dc operation.
Dynamotor inoperative. Power Supply PP-1711/GRC-14 inoperative. No readings on TEST meter for +1KV, +250V, and BIAS positions.	F1407	Ac or dc operation.
No reading on TEST meter for +250V and Ic2 positions (10 to 15 MA)	F1408	
No reading on TEST meter for +1KV position (+1100 volts).	F1409	
No reading on TEST meter for BIAS position (—105 volts).	F1410	

TABLE 5-4. FUSE LOCATIONS AND DATA

SYMBOL	PROTECTS	AMPS	VOLTS	MIL TYPE
POWER SUPPLY PP-1711/GRC-14				
F1401	Primary of transformer T1401	20	125	F03D20R0B
F1402	26.5-volt dc receiver supply	10	125	F03G10R0B
F1403	Crystal oven heaters	10	125	F03G10R0B
F1404	26.5-volt dc control circuit	10	125	F03G10R0B
F1405	26.5-volt dc filament and blower circuits	15	250	F03G15R0B
F1406	Primary of transformer T1402	5	125	F03G5R00B
F1407	Dynamotor D1401	60	125	F40D60R0B
F1408	312-volt dc power circuit	1	500	F60H1R00C
F1409	1100-volt dc power circuit	1	1000	F27J1R00A
F1410	—105-volt dc bias circuit	0.187	125	F03GR187B
F1411	Spare for F1401	20	125	F03D20R0B
F1412	Primary of transformer T1402	10	125	F03G10R0B
F1413	Spare for F1403	10	125	F03G10R0B
F1414	Spare for F1404	10	125	F03G10R0B
F1415	Spare for F1405	15	250	F03G15R0B
F1416	Spare for F1406	5	125	F03G5R00B
F1417	Spare for F1407	60	125	F40D60R0B
F1418	Spare for F1408	1	500	F60H1R00C
F1419	Spare for F1409	1	1000	F27J1R00A
F1420	Spare for F1410	0.187	125	F03GR187B
AMPLIFIER-POWER SUPPLY IN RADIO RECEIVER R-808/GRC-14				
F1501	Spare for F1503	5	250	F02G5R00A
F1502	Spare for F1504	2	250	F02G2R00A
F1503	26.5-volt dc input circuit	5	250	F02G5R00A
F1504	Primary of transformer T1521	2	250	F02G2R00A

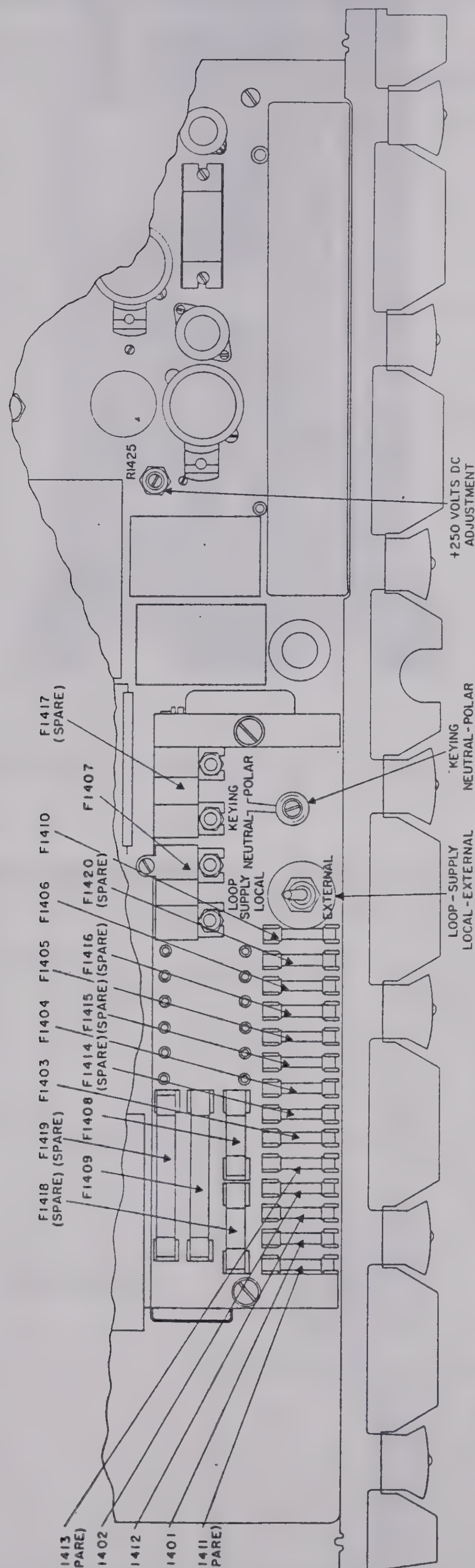


Figure 5-1. Fuse Locations, Power Supply PP-1711/GRC-14

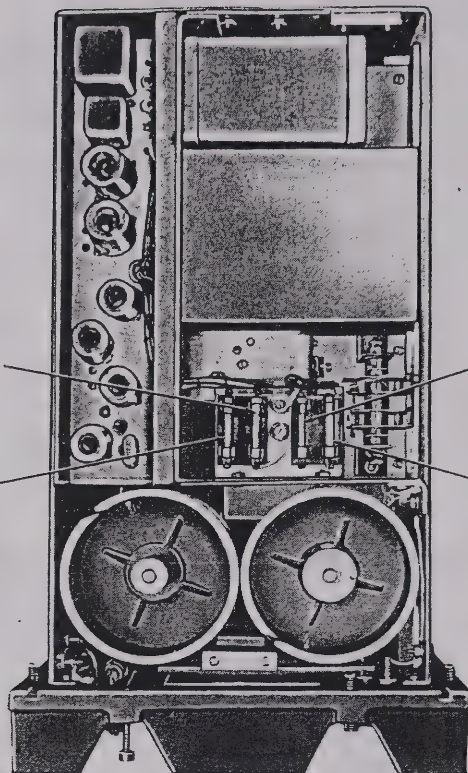


Figure 5–2. Fuse Locations, Amplifier-Power Supply

TABLE 5–5. ELECTRON TUBE, TRANSISTOR AND DIODE LOCATION

SUBASSEMBLY	SYMBOL DESIGNATION	TYPE
RADIO TRANSMITTER T–631/GRC–14		
Variable frequency oscillator	CR101	1N645
	CR102	1N645
	CR103	1N645
	V101	5814A
	V102	5687WA
Reference oscillator and mixer	V401	12AT7WA
	V402	5654/6AK5W
	V403	5654/6AK5W
	V404	5654/6AK5W
	V405	5654/6AK5W
	V406	5750/6BE6W
	V407	5725/6AS6W
Mixer-stabilizer	CR701	1N69
	CR702	1N69
	V701	6AH6
	V702	6AH6
	V703	6AH6
	V704	6AH6
	V705	6AH6
	V706	6AH6
Keyer group	CR801	1N645
	CR802	1N645
	CR803	1N645
	V801	6005/6AQ5W
	V802	6005/6AQ5W
Servo control	V901	5751
	V902	12AT7WA
	V903	5751
	V904	12AT7WA
	V905	5687WA
Amplifier-modulator	CR1001	1N69
	CR1002	1N69
	CR1003	1N69
	CR1004	1N69
	CR1005	1N540
	CR1006	1N540
	CR1007	1N540
	CR1008	1N540
	CR1009	1N69
	V1001	6CL6
	V1002	4X250F
	V1003	4X250F
	V1004	4X250F

TABLE 5–5. ELECTRON TUBE, TRANSISTOR AND DIODE LOCATION (cont)

SUBASSEMBLY	SYMBOL DESIGNATION	TYPE
Audio-frequency amplifier	V1101	12BA6
	V1102	12AT7WA
	V1103	12AT7WA
Radio-frequency tuner	CR1201	1N69
	CR1202	1N69
	CR1203	1N69
	CR1204	1N69
POWER SUPPLY PP–1711/GRC–14		
Power supply	CR1401	4JA60A
	CR1402	4JA60A
	CR1403, CR1404	4JA11DC1AD1
	V1401	6082
	V1402	6082
	V1403	5751
	V1404	5651
RADIO RECEIVER R–808/GRC–14		
Receiver main chassis	Q1503	2N539
	Q1505	2N174
	Q1506	2N174
Radio-frequency head	V1501	6AJ5
	V1502	6AJ5
	V1503	12AT7WA
	V1504	6AJ5
	V1505	5750/6BE6W
	V1506	6AJ5
	V1507	6AJ5
Amplifier-power supply	CR1501	1N69
	CR1502	4JA411BC1ADZ
	CR1504	1N69
	CR1505	ZA-8
	Q1501	2N340
	Q1502	2N340
	Q1504	2N117
	V1508	12AT7WA
	V1510	6AJ5
	V1511	6AJ5
	V1512	6AJ5
	V1513	12AT7WA
	V1514	6AJ5
Intermediate-frequency amplifier	V1601	6AJ5
	V1602	6AJ5
	V1603	6AJ5
	V1604	6AJ5
	V1605	12AT7WA
	V1606	6AJ5
Frequency-shift converter, af-type	CR1701	1N645
	CR1702	1N645
	CR1703	1N645
	CR1704	1N645
	CR1705	1N645
	Q1701	2N340
	Q1702	2N340
	V1701	26A6
	V1702	26A6
	V1703	26A6
	V1704	26A6
Frequency-shift converter, if-type	CR1751	1N251
	CR1752	1N251
	Q1751	2N340
	Q1752	2N340
	V1751	26A6
	V1752	26A6
	V1753	26A6
	V1754	5814A

NOTES

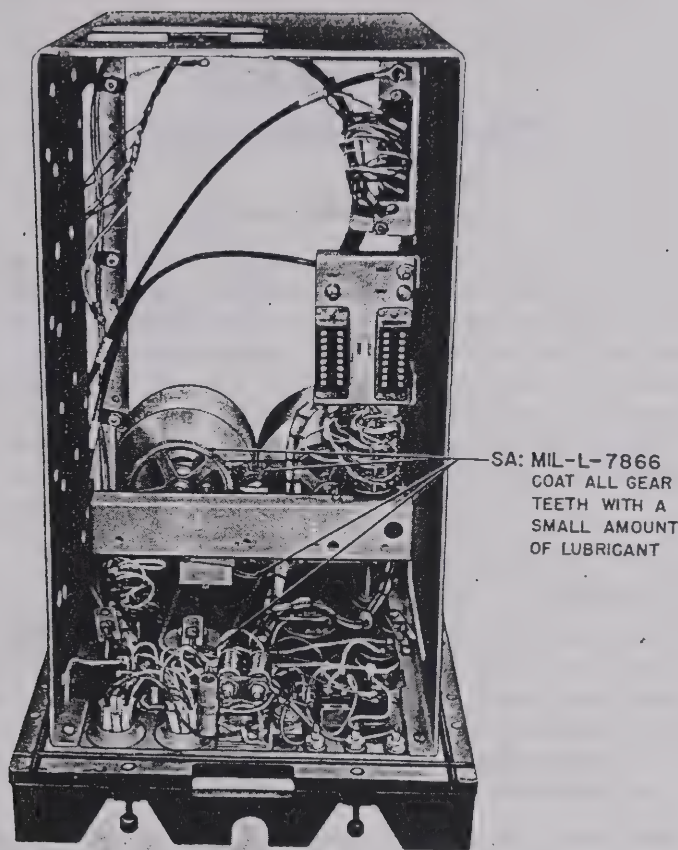


Figure 6-4. Receiver Main Chassis, Lubrication

Note

Clean before lubricating. Do not over-lubricate.

Power Supply PP-711/GRC/14, Radio Set Control Group OA-1444/GRC-14 and Generator Installation Kit MK-366/MRC-55 do not require special lubrication. The alternator unit in the latter is equipped with pre-lubricated neoprene sealed bearings.

a. RADIO TRANSMITTER T-631/GRC-14.—Certain parts of the transmitter are self-lubricated; however, the following subassemblies require lubrication.

(1) MAIN CHASSIS. — Figure 6-1 gives lubrication instructions for vfo dial drive assembly and the rack drive assembly.

(2) AMPLIFIER-MODULATOR. — Figure 6-2 gives lubrication instructions for the gear train, band switch S1002, and the lead screw.

(3) RF TUNER. — Figure 6-3 gives lubrication instructions for the gear trains, lead screws, and ball bearing screw jack.

b. RADIO RECEIVER R-808/GRC-14. — Some parts of the radio receiver are self-lubricated; however, all gear teeth of the dial drive assembly, the bandswitch sprocket, and chain in the receiver main chassis require lubrication (figure 6-4).

SECTION 7
CORRECTIVE MAINTENANCE

FAILURE REPORT

Report each failure of the equipment, whether caused by a defective part, wear, improper operation, or an external cause. Use ELECTRONIC FAILURE REPORT form DD787. Each pad of the forms includes full instructions for filling out the forms and forwarding them to the Bureau of Ships. However, the importance of providing complete information cannot be emphasized too much. Be sure that you include the model designation and serial number of the equipment (from the equipment identification plate), the type number and serial number of the major unit (from the major unit identification plate), and the type number and reference designation of the particular defective part (from the technical manual). Describe the cause of the failure completely, continuing on the back of the form if necessary. Do not substitute brevity for clarity. And remember—there are two sides to the failure report—

YOUR SIDE

Every FAILURE REPORT is a boost for you:

1. It shows that you are doing your job.
2. It helps make your job easier.
3. It insures available replacements.
4. It gives you a chance to pass your knowledge to every man on the team.

BUREAU SIDE

The Bureau of Ships uses the information to:

1. Evaluate present equipment.
2. Improve future equipment.
3. Order replacements for stock.
4. Prepare field changes.
5. Publish maintenance data.

Always keep a supply of failure report forms on board. You can get them from the nearest Forms and Publications Supply Distribution Point.

7-1. INTRODUCTION.

The information contained in this section covers procedures and instructions for trouble location, repair, and alignment of all major components in Radio Set AN/MRC-55.

Maintenance personnel must be prepared to repair and restore the equipment to normal operation. The trouble must be determined and localized as quickly and accurately as possible and, further, the cause of the trouble must be determined so that recurrence of equipment failure may be prevented. When repairs or replacements are made, every attempt should be made to duplicate the original condition of the equipment. Standard replacement parts should always be used.

Emergency repairs should be used on a temporary basis only, with every effort made to restore the equipment to its original condition at the earliest possible opportunity.

7-2. THEORY OF LOCALIZATION.

When the radio set operates incorrectly or fails to operate, the source of trouble should be located as quickly as possible by a systematic troubleshooting procedure. The troubleshooting procedure most effective for locating troubles involves a process of elimination commonly referred to as localization. The first step in trouble localization is to trace the fault to the functional operating group responsible for the abnormal operation or failure of the equipment. In this case, the first step is to determine whether the transmitter, receiver, power supplies, or control set is at fault. The second step is to localize trouble within a major unit and isolate the faulty subassembly within that unit. The final step is to find the defective part or parts in the circuit.

7-3. TROUBLESHOOTING AND REPAIR, GENERAL.

This part of the corrective maintenance section contains general instructions for maintenance personnel. Detailed instructions for corrective maintenance are outlined separately for each functional operating group.

The principal units of Radio Set AN/MRC-55 equipment are mounted in four equipment cabinets. Most of the units mounted within these cabinets are removable plug-in subassemblies using printed wiring. All interconnecting cables enter the cabinets via front panel connectors.

a. OVERALL TROUBLESHOOTING PROCEDURES.—Troubleshooting procedures should be accomplished in a logical manner. The equipment has various modes of operation. Therefore, troubles can

often be located by attempting operation on the different modes, thus localizing trouble to specific groups of subassemblies. Front panel meters should be observed and the troubleshooting charts (tables 7-2, 7-3, 7-4, 7-7, and 7-8) consulted as further aids in localizing trouble. Standard troubleshooting procedures outlined in NAVSHIPS 91828, Handbook of Test Methods and Practices, should be followed.

For corrective maintenance, the standard Navy-type test equipment (or equivalent) listed in table 7-1 will be required. For overall troubleshooting, refer to table 7-2.

TABLE 7-1. TEST EQUIPMENT REQUIRED FOR CORRECTIVE MAINTENANCE

TEST UNIT	REQUIRED CHARACTERISTICS	RECOMMENDED TYPE
Multimeter (vtvm)	Measure ohms, ac-dc volts, current, rf voltages of 455 kc to 45 mc range.	ME-26/U, H.P. 410B
Vacuum tube voltmeter (ac)	Measure rf voltages of 2 to 30 mc range.	ME-6/U
RF signal generator	455 kc to 45 mc range.	AN/URM-25
Sweep generator	1.5 to 4 mc sweep.	SG-92/U
Frequency counter	455 kc to 45 mc range.	AN/USM-26
Oscilloscope		DuMont type 304A or OS-8A/U
AF signal generator	20 cps to 20 kc range.	LAJ series
Dummy load	600 ohms, 2 watts 50 ohms	 DA 91/U
Megger	0.1 to 10,000 megohms, 500-volt test	
Adapter set		49416, 49598, 49992
Dummy antenna	2-8 mc: 5 ohms in series with 80 $\mu\mu$f. 8-16 mc: 40 ohms in series with 300 $\mu\mu$f. 16-32 mc: 250 ohms.	
Microammeter	50-0-50 scale	M1302, M1501

b. MAINTENANCE OF PRINTED WIRING CIRCUITS.—All subassemblies in the transmitter, with the exception of the keyer group and rf tuner, use printed wiring. The receiver uses printed wiring in the if amplifier and the fs converter subassemblies. Power Supply PP-1711/GRC-14 also uses printed wiring to a small degree.

(1) GENERAL.—Troubleshooting of printed circuits is similar to troubleshooting of conventional wired circuits. Since the printed boards are translucent, a 60-watt light bulb can sometimes be placed underneath the side being traced to facilitate locating the connections or open circuits. In some cases, a magnifying glass will assist in locating very small breaks in the wiring. Resistance or continuity measurements of coils, resistors, and capacitors can be made from either side of the board. However, on the wiring side of the board two needle point probes should be used since the lacquer coating must be broken through to make contact.

(2) PRECAUTIONS.

(a) When removing components from the board, be careful to prevent damage to the printed wiring.

(b) Do not apply excessive pressure to the printed circuit board.

(c) Avoid overheating the printed wiring and component terminals. Excessive heat applied by a conventional high-wattage soldering iron or gun may cause the bond between the board and the wiring to break. It is advisable to use a low-wattage (20 to 50 watts) soldering iron to repair printed wiring boards.

(3) TOOLS AND EQUIPMENT.

(a) Solder (type 60/40 with resin core).

(b) Soldering iron (20 to 50 watts).

(c) Lacquer (silicon resin or plastic spray, Krylon or equivalent).

(d) Solvent (methyl alcohol).

(e) Cloth.

(f) Solder pick.

(g) Small wire brush.

(h) Penknife.

(4) REMOVAL OF PRINTED WIRING BOARDS.—It will seldom be necessary to remove the printed board from the subassembly. In most cases, access to the underside is possible without removing the printed board. If removal is necessary, unsolder all connections to the printed board (after identifying the leads and their terminations) and remove the screws securing the board to the subassembly.

(5) REPLACEMENT OF COMPONENTS.—Removal of components such as small resistors and capacitors, that leave a portion of the lead wires exposed between the wiring board and component body, may be accomplished by clipping the leads next to the body. This leaves small wire terminals to which new components may be soldered. If the leads are not long

enough, cut the defective component in half. Then cut through each half until it is broken away from its leads. By this means, sufficient lead length from inside the component will be gained. To install the replacement part, wrap one turn of each lead around each wire terminal (left after removing the old component) and solder the connection.

It may be desired to remove one or both leads of a component from the board without cutting the leads. This is done when the component is to be tested. To do this, heat the connection on the underside of the board with a low-wattage soldering iron. When the solder melts, brush it away with a small wire brush and solder pick. Do not overheat the connection. It may require more than one heating to remove all of the solder, but caution must be taken to avoid excessive heating. Do not leave the iron on the connection while brushing away the solder. Melt the solder, remove the iron, and quickly brush the melted solder away. Then insert a knife blade between the wiring foil and the bent-over component lead and bend the lead perpendicular to the board. While applying the iron to the connections, wiggle the lead until it breaks free while the solder is still molten. Clear the area of any scattered solder, using a cloth and solvent such as methyl alcohol. To reinstall the component, bend over the ends of the component leads against the wiring foil and then resolder the connection with 60/40 low-temperature resin core solder.

Note

It is recommended that new connections be coated with silicone-resin lacquer or a plastic spray for protection against shorts.

(6) REPAIR OF PRINTED WIRING.—Small breaks in the wiring can be filled in with molten solder. Larger breaks can be jumped with ordinary hook-up wire.

TABLE 7–2. RADIO SET AN/MRC–55 OVERALL TROUBLESHOOTING CHART

TROUBLE	SYMPTOMS	PROBABLE CAUSE	CORRECTIVE ACTION
Transmitter or receivers inoperative.	Dial lights not lit with DIAL DIMMER controls fully clockwise.	No input power.	Refer to table 7–4.
Transmitter and receiver No. 1 inoperative.	Unable to tune transmitter. No reception on receiver No. 1; normal reception on receiver No. 2.	Faulty antenna or transmission line.	Inspect connectors for deterioration. Use an ohmmeter to take continuity check. Take a megger reading on transmission line.
Transmitter inoperative.	No indication on R-F LINE meter.	Faulty transmitter or power supply.	Refer to table 7–3.
Transmitter output erratic after being tuned.	TUNE and LOAD meters on front panel erratic.	Malfunction of rf tuner resulting from dust on shorting drum. Poor contact between ribbon conductor and shorting drum.	Clean shorting drum with dry cleaning solvent (P–S–661B).
Operation not possible from local remote control.	No reception or transmission on handset at local remote control; operation normal at receptacles on transmitter.	Faulty local remote control. Faulty handset.	Check continuity of circuits in local remote control. Check or replace handset.
Operation not possible from local or field remote controls.	No reception or transmission at either remote control; operation normal at receptacles on transmitter.	Faulty remote control.	Check interconnecting cables. Refer to table 7–8.
Operation not possible from field remote control in either AM, CW/FSK or TEL.	No reception or transmission at field remote control; operation normal from local remote control.	Faulty field remote control.	Check interconnecting cables. Refer to table 7–8.
No re-transmission of received voice signals with NORMAL REMOTE-RELAY switch on transmitter at RELAY position.	Radio set inoperative.	Receiver squelch circuit operating improperly.	Adjust R-F GAIN SQUELCH control in accordance with section 4.

c. MAINTENANCE OF TRANSISTORIZED CIRCUITS.

(1) GENERAL.—Transistors are generally more rugged mechanically than vacuum tubes. However, they are still comparatively easy to damage by improper treatment or electrical overload. Precautions must be observed which are not normally necessary with vacuum tube circuits.

(2) PRECAUTIONS AND TESTING.—Take care when replacing transistors. Do not overheat transistors or their leads, since excessive heat can easily cause permanent damage. Use a soldering iron of the lowest wattage available. The transistor lead being soldered or unsoldered should be grasped gently with a long nose pliers between the soldering iron and the transistor to help dissipate the heat.

The most effective way of determining whether a transistor is defective is to replace it. However, this technique should only be used after it has been determined that there are no other circuit defects. When testing, a transistor can be easily damaged by application of improper voltages; therefore, an ohmmeter should never be used to check transistors. Damage to the transistor will result from placing the wrong polarity ohmmeter probes on the transistor terminals. A transistor should first be removed from the circuit if it is necessary to check any of its associated components with an ohmmeter. Only voltage measurements should be taken at the transistor terminals.

A defective transistorized stage will usually be located by an incorrect voltage at the transistor terminals. The incorrect voltage will usually be caused by a defective transistor, a defective component part in the stage (or in the next stage), or by trouble in the power supply.

7–4. TRANSMITTER AND POWER SUPPLY TROUBLESHOOTING AND REPAIR.

(See figures 7–1 through 7–32 and 7–57 through 7–77.)

a. TROUBLESHOOTING PROCEDURES. — The technician should first consult the transmitter troubleshooting chart (table 7–3) and the power supply troubleshooting chart (table 7–4) as troubleshooting aids when a failure occurs in the transmitter. The checks listed in the charts are those which may be made with a minimum of time and test equipment. In many cases, however, the trouble may not be easily localized. In such cases, the technician should adopt a systematic procedure to localize the trouble. (Refer to the schematics and voltage and resistance charts for the respective units.) The following procedures may be used as an aid in troubleshooting the transmitter.

(1) If the transmitter operates on all services except fsk, but there is no vfo stabilization, the trouble will probably be found in the reference oscillator and mixer subassembly or the mixer-stabilizer subassembly. If tube replacement in accordance with table 7–2 does not remedy the trouble, further localization should be performed using a dc voltmeter and a voltmeter capable of measuring rf voltages to 40 mc. The measurements obtained should be compared with the values given in table 7–5 to determine if they are normal.

For convenience, place the SERVICE switch at the NETTING position, which will remove the fixed bias from vfo stage V101, allowing it to operate.

The first step in localizing this trouble is to place the dc voltmeter at TP–J707. The reading (32 volts) will vary, plus and minus, as the VFO ADJ goes through the locked-in range. If no reading is obtained at TP–J707, the trouble will be found in the mixer-

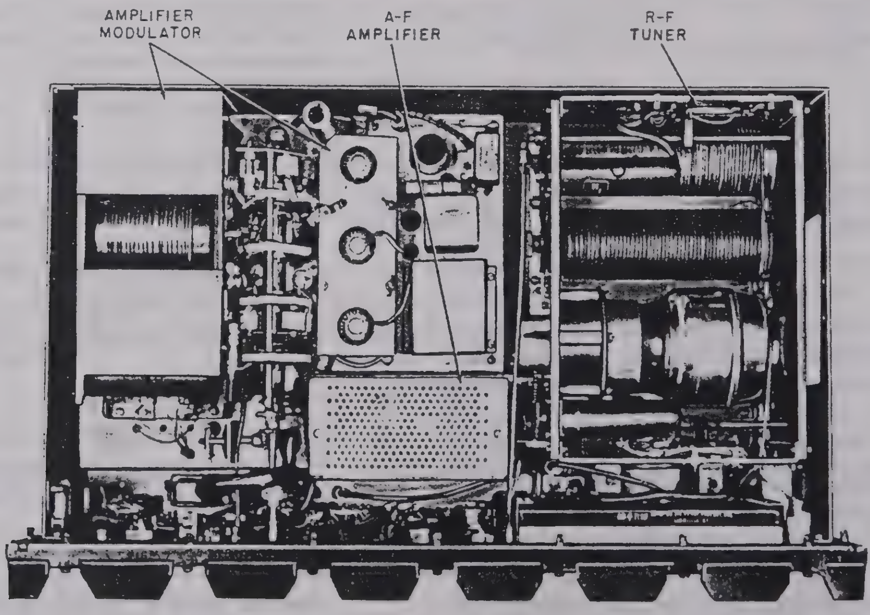


Figure 7–1. Radio Transmitter, Top View

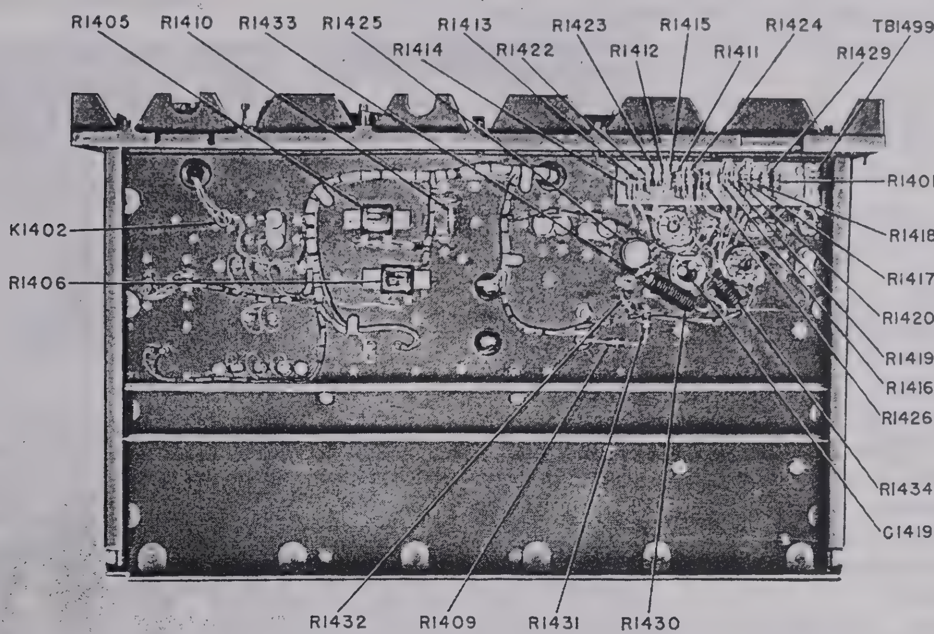
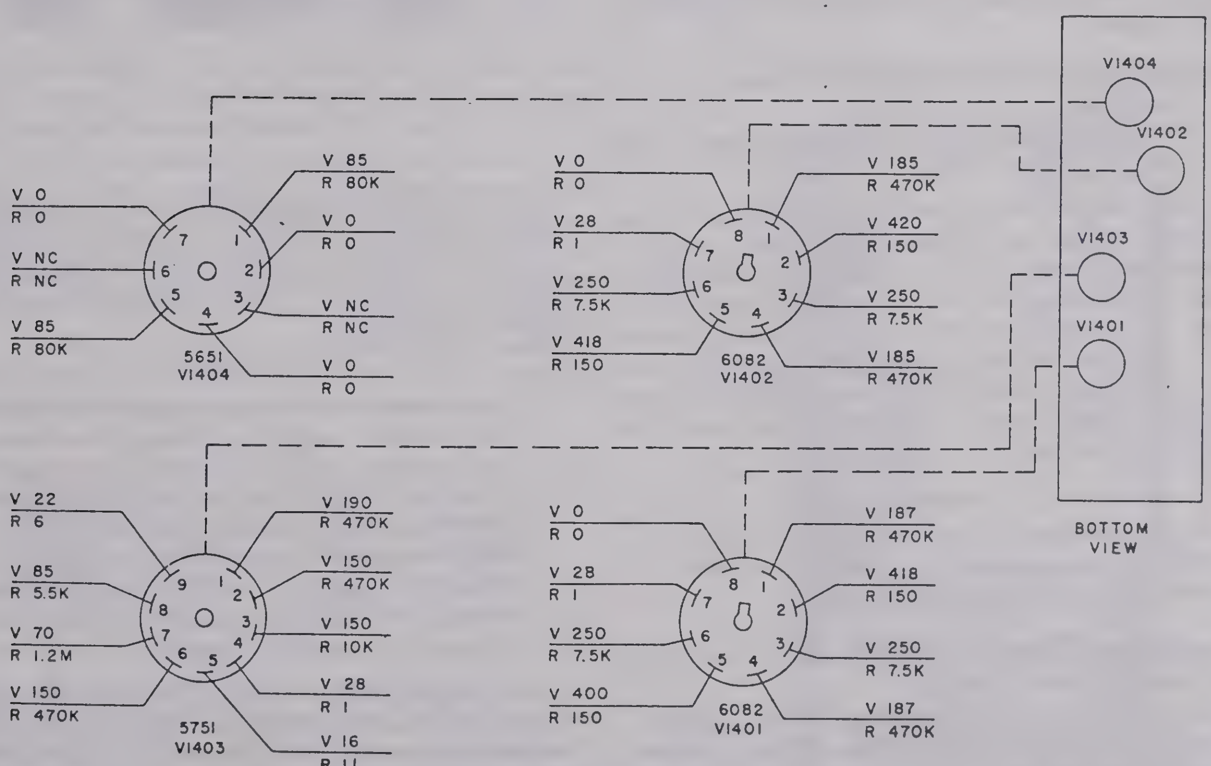


Figure 7-31. Power Supply, Bottom View



NOTES
1. UNLESS OTHERWISE INDICATED, ALL VOLTAGE ARE POSITIVE DC VOLTAGES TAKEN WITH REFERENCE TO GROUND; VOLTAGES TAKEN WITH A SIMPSON MODEL 260 (20,000 OHMS PER VOLT), AND MEASURED IN VOLTS.
2. ALL RESISTANCE READINGS TAKEN WITH REFERENCE TO GROUND; RESISTANCE READINGS TAKEN WITH SIMPSON MODEL 260; K=1000 OHMS; M=1,000,000 OHMS.

Figure 7-32. Power Supply, Voltage and Resistance Chart

V405 is three times the crystal frequency. The output from V405 is heterodyned with the outputs from the vfo subassembly and oscillators V403 and V404 to obtain a comparison frequency in the 2 to 3 mc range.

CRYSTAL	FREQUENCY	V405 OUTPUT FREQUENCY
Y427	11.667 mc	35 mc
Y428	13.333 mc	40 mc

(2) CRYSTAL CHARACTERISTICS. — The 28 crystals used in the transmitter are all of the same type and therefore have the same characteristics. The crystals are type CR-36/U and are hermetically sealed in crystal holders (type HC-6/U). The crystals have an accuracy of ±0.0005 percent from the frequency at 85 degrees C (reference temperature) throughout their operating temperature range of 80 degrees to 90 degrees C. The tolerance of the crystals at the 85 degrees C reference temperature is ±0.002 percent of their designated frequency.

(3) CRYSTAL HOLDER CHARACTERISTICS. —The crystal holders (type HC-6/U) have the following physical dimensions: length 0.750 inch; width 0.345 inch; height 0.765 inch (less pins); number of pins 2; spacing of pins 0.486 inch; diameter of pins 0.050 inch. The crystal is wire-mounted in the metal crystal holder.

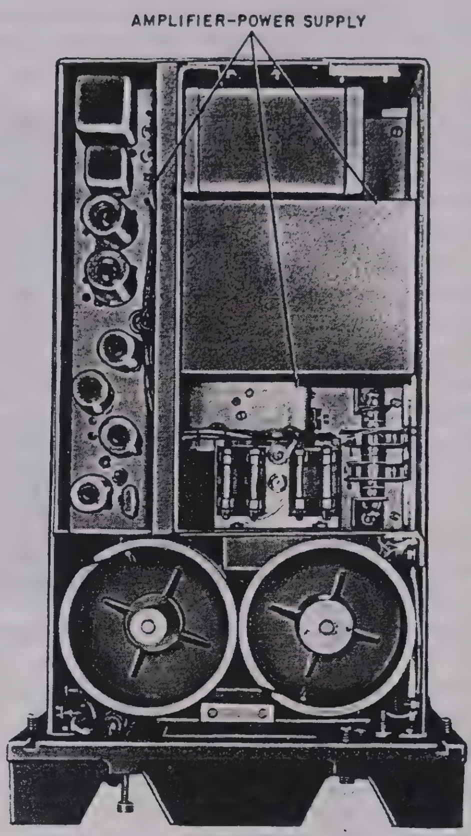


Figure 7–33. Radio Receiver, Top View

7–5. RECEIVER TROUBLESHOOTING AND REPAIR.

(See figures 7–33 through 7–52 and 7–78 through 7–89.)

a. TROUBLESHOOTING PROCEDURES. — The technician should first consult the receiver troubleshooting chart (table 7–7–) as a preliminary aid whenever a failure occurs in the receiver. The checks listed in the chart are those which may readily be made with a minimum of time and test equipment. In such cases where the trouble is not easily localized, the technician should adopt a systematic procedure to localize the trouble.

Note

If the receiver is operative but the output level is low, a sensitivity check of the subassemblies should be performed.

The following procedures may be used as an aid in troubleshooting the receiver.

(1) If the receiver is inoperative on cw, mcw, and phone, but operates normally on fsk, as evidenced by indications on the TELETYPE TUNING meter, the rf head and the first three if. stages are eliminated as a possible source of trouble, as is also bfo stage V1606. If the OPERATION SWITCH is in the BROAD PHONE position, the squelch circuit should be disabled by rotating the RF GAIN SQUELCH control fully ccw before starting troubleshooting. As a quick check, the technician should replace V1604, V1605, V1513, and V1508. If the trouble is still present, start signal tracing. A tube adapter set (type 49416 or equivalent) should be used to gain access to the tube pins.

CAUTION

Care must be taken while signal tracing to prevent the stages from being overdriven, and thereby obtaining inconclusive results. The output level of the signal generator should initially be set at a low level. If amplifier stages are operating correctly, an increase in output level should be heard as the output of the signal generator is moved towards the receiver front end.

An audio frequency signal (400 cycles) from a signal generator (type LAJ or equivalent) should be injected at the input (pin 2) of audio driver V1508. If an output signal is heard in the loudspeaker or headset, the trouble is probably caused by relay K1502, CR1504, V1513A, fourth if. amplifier V1604, or detector stage V1605A. If an output signal was not heard with a signal injected at pin 2 of V1508, the loudspeaker or headset and interconnecting cables should first be checked, by applying an audio signal

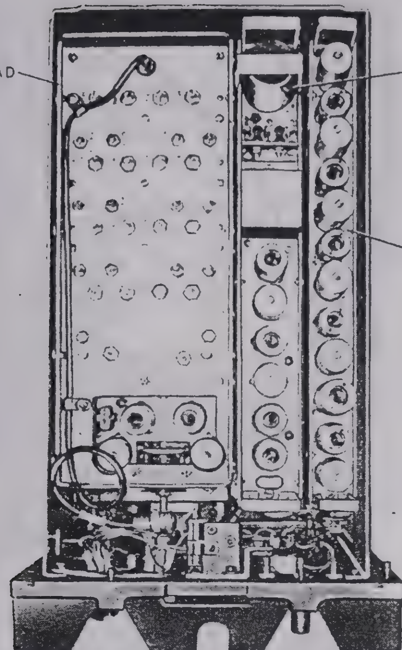


Figure 7-34. Radio Receiver, Bottom View

between terminal 4 of T1518 and ground. If an output is heard, the trouble is in the audio output stage (Q1501, Q1502).

(2) If the receiver is operative on all services except fsk, the fs converter is probably at fault. Replace tubes and check transistor voltages. If tube or transistor replacement fails to cure the trouble, it will be necessary to signal trace the fs converter. Use the TELETYPE TUNING meter as an output indicator.

(3) If the receiver is inoperative for all services, the trouble will be found in the rf head or in the first three stages of the if. amplifier subassembly.

Note

If fsk transmissions are not available, the audio frequency amplifiers and the fourth if. amplifier (V1604) and detector (V1605A) stages cannot be eliminated. These stages should be checked in accordance with paragraph 7-5 *a* (1).

Place the front panel BAND SWITCH on band 1 or 2. This bypasses 1500-kc amplifier V1504 and converter V1505. If the receiver operates on bands 1 and 2 but is inoperative on bands 3 and 4, the trouble will be found in the V1504 or V1505 stage. If the receiver is inoperative on all four bands, disable the squelch circuit (phone operation) by rotating the RF GAIN SQUELCH control fully counterclockwise, and begin troubleshooting.

Replace tubes V1501, V1502, V1503, V1506, V1507, V1601, V1602, and V1603. If the trouble is still present, begin signal tracing. Apply an audio modulated

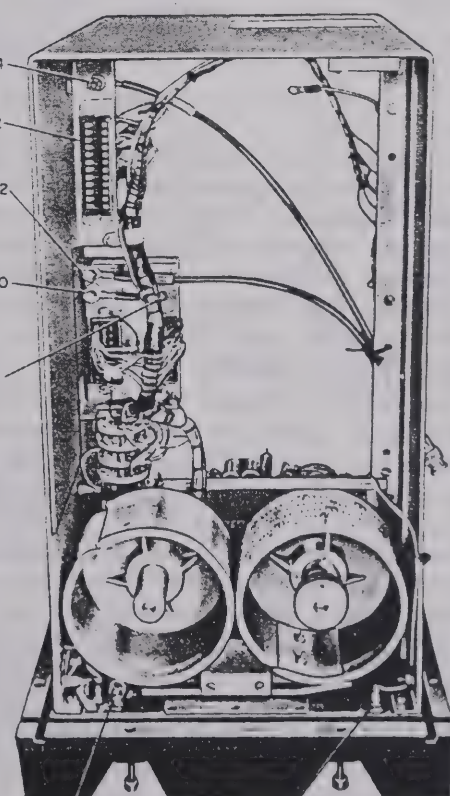


Figure 7-35. Receiver Main Chassis, Top View

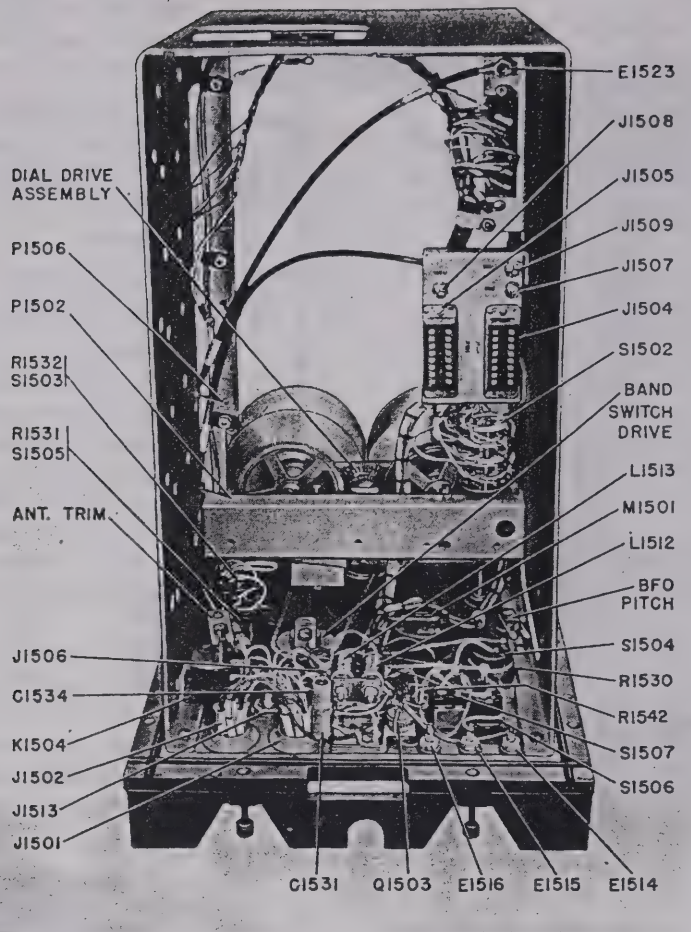


Figure 7–36. Receiver Main Chassis, Bottom View

455-kc signal from a signal generator (LP series or equivalent) to the input of the if. amplifier at P1602. If there is no audio output from the loudspeaker or headset, the trouble will probably be found in the first, second, or third if. amplifier stages. Apply the modulated 455-kc signal to the control grids (pin 1) of V1603, V1602, and V1601, respectively, until the defective stage is isolated.

If an output is heard with an audio modulated 455-kc signal applied at P1602, the trouble will be found in the rf head. The receiver should be set for phone operation on band 1 or 2. Replace tubes V1501, V1502, V1503, V1506 and V1507. (V1504 and V1505 are used only for band 3 and 4 operation.) If tube replacement does not remedy the trouble, start signal tracing.

Tune the receiver to any frequency within the band being used. Adjust an rf signal generator (LP series or equivalent) to obtain an audio modulated signal at the same frequency as that indicated on the receiver FREQUENCY dial. Inject this signal at the control grid (pin 7) of mixer tube V1503. If no output is heard from the receiver, the trouble will be found in mixer stage V1503, oscillator stage V1506, or harmonic amplifier stage V1507.

If an output was heard with a modulated rf signal injected at the control grid of V1503, the trouble will be found in the first or second rf amplifiers, V1501 and V1502, or the antenna input circuit. Isolate the faulty stage by applying a modulated rf signal at the control grid of each of the rf stages, and finally, if necessary, at the antenna input receptacle.

b. MECHANICAL ADJUSTMENTS.—The following procedures outline the methods to be followed for removal and repair of receiver components.

(1) SUBASSEMBLY REMOVAL. — All receiver subassemblies may be removed from the main chassis. To obtain access to the subassemblies, loosen the front panel fasteners and remove the main chassis from the cabinet. The following procedures should be followed to remove the subassemblies. (See figures 7–33 through 7–36.)

(a) AMPLIFIER-POWER SUPPLY.—The amplifier-power supply is a plug-in unit mounted on the top of the receiver main chassis. (See figures 7–33, 7–37, 7–38 and 7–39.) To remove the subassembly:

Step 1. Loosen mounting screws that secure subassembly to main chassis and gently lift unit to

disconnect P1504 from J1512. Then disconnect J1514 from P1503 and remove unit.

Step 2. To replace amplifier-power supply in main chassis, reverse removal procedure.

(b) RADIO FREQUENCY HEAD. — The rf head is a removable subassembly mounted on the underside of the receiver main chassis. (See figures 7-34 and 7-43 through 7-45.)

1. REMOVAL.

Step 1. Place BAND SWITCH at the 2-4 MC position and ANT. TRIM. control fully counterclockwise.

Step 2. Disconnect the following: P1505 from J1513 (bottom); P1502 from J1510 (right side); P1506 from J1511 (right side); antenna wire lead from feed through terminal E1525 (right side). Also, disconnect the power supply wire leads from terminal board TB1501 (rear), making a note of connections (color code and terminal numbers) removed so that the leads may be replaced properly later on.

Step 3. Rotate the TUNE knob to extreme ccw position (FREQUENCY dial at zero index mark).

Step 4. Loosen two allen cap screws on shaft coupling MP1530. This coupling is accessible through side cut-out of main chassis and couples shaft of tuning capacitor C1501 to dial drive shaft on main chassis. Slide coupling toward capacitor C1501 until shafts separate.

Step 5. Remove four mounting screws that secure rf head and lift subassembly out. It may be desirable to loosen two mounting screws on fs converter subassembly to facilitate removal of rf head.

2. REPLACEMENT.

Step 1. Set switch S1501 and antenna trimmer coupling arms pointing toward bottom of unit. Make sure that BAND SWITCH on front panel is at

TABLE 7-7. RADIO RECEIVER TROUBLESHOOTING CHART

TROUBLE	SYMPTOMS	PROBABLE CAUSE	CORRECTIVE ACTION
Both receivers inoperative on ac input only.	Dial light not lit with DIAL DIMMER fully clockwise.	No input power.	Refer to table 7-4.
Only receiver No. 1 or receiver No. 2 inoperative on ac input only.	Dial light not lit with DIAL DIMMER fully clockwise.	Fuse F1504 open. Faulty rectifier circuit.	Check fuse and replace if necessary. Check CR1502 and T1521.
Both receivers inoperative on dc input only.	Dial light not lit with DIAL DIMMER fully clockwise.	No input power.	Refer to table 7-4.
Only receiver No. 1 or receiver No. 2 inoperative on dc input only.	Dial light not lit with DIAL DIMMER fully clockwise.	Fuse F1503 open.	Replace fuse.
Receiver inoperative on bands 3 and 4 only.	No output for any mode of operation.	Faulty tube V1504 or V1505.	Replace tubes.
Receiver inoperative only at CW SHARP position of OPERATION SWITCH.	No output.	Faulty filter FL1501.	Replace filter.
Receiver inoperative only at CW, SHARP and CW, FSK BROAD positions of OPERATION SWITCH.	No cw reception.	Faulty tube V1606.	Replace tube.
Receiver inoperative only at CW, FSK BROAD and FSK, PHONE positions of OPERATION SWITCH.	No fsk reception.	Faulty tube, transistor, or crystal rectifier in frequency shift converter.	Replace tube(s) and/or transistor(s) and/or crystal rectifier.
Receiver inoperative only at BROAD PHONE position of OPERATION SWITCH.	No voice reception.	R-F GAIN SQUELCH control improperly set.	Readjust R-F GAIN SQUELCH control.
Calibrating receiver main tuning dial impossible with OPERATION SWITCH at the CAL position.	No beat signals present.	Faulty tube V1512 or V1510.	Replace tubes.

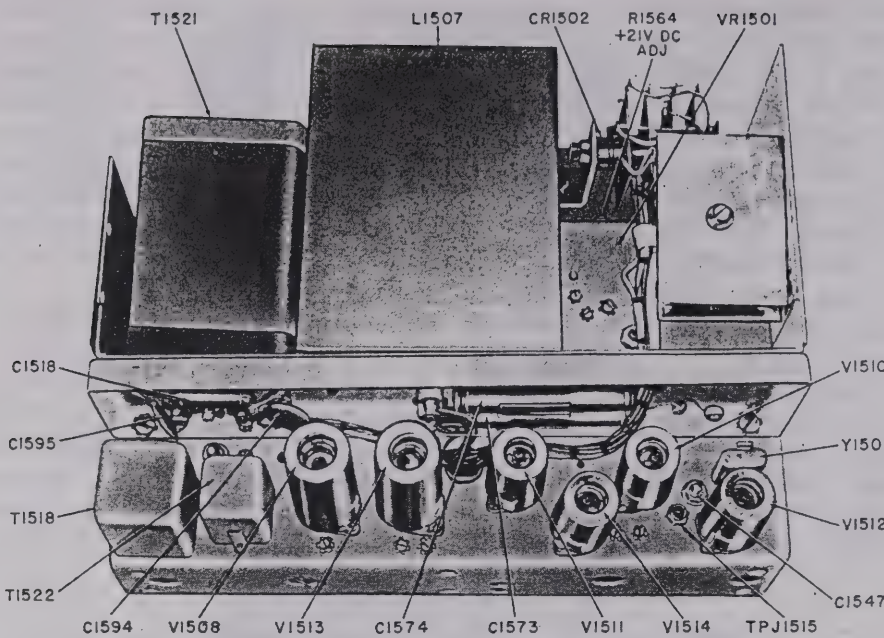


Figure 7–37. Amplifier-Power Supply, Top View

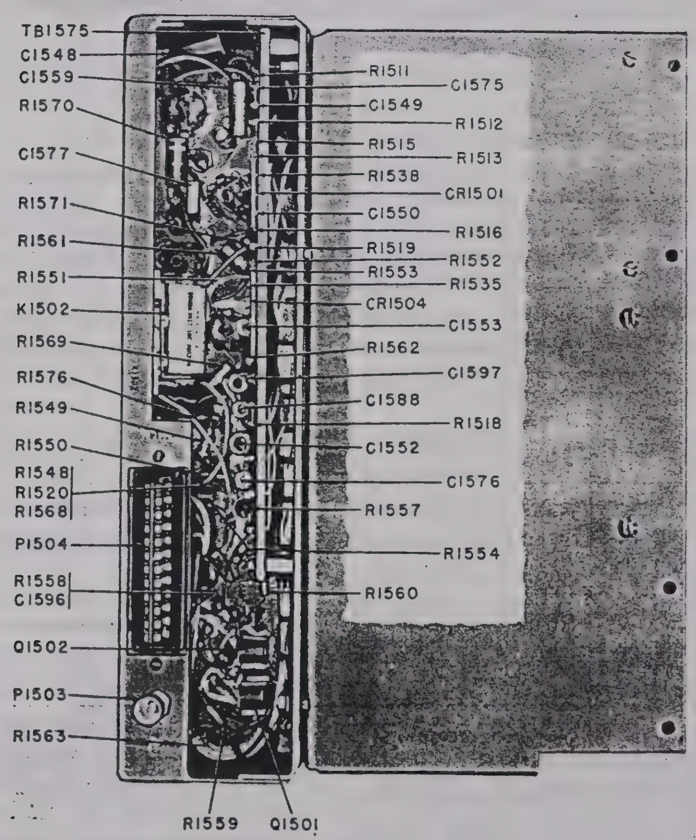
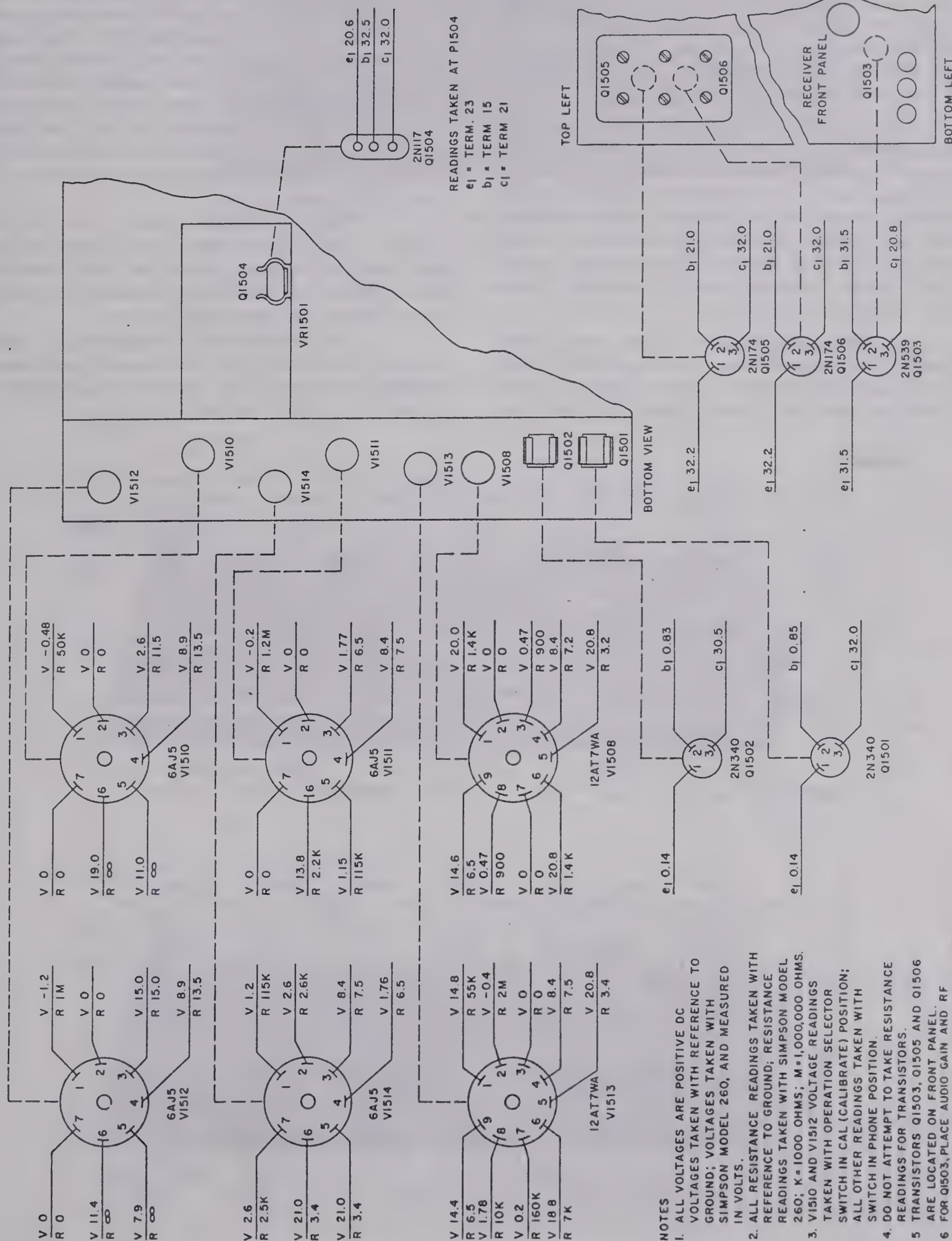


Figure 7–38. Amplifier-Power Supply, Bottom View



NOTES
1. ALL VOLTAGES ARE POSITIVE DC VOLTAGES TAKEN WITH REFERENCE TO GROUND; VOLTAGES TAKEN WITH SIMPSON MODEL 260, AND MEASURED IN VOLTS.
2. ALL RESISTANCE READINGS TAKEN WITH REFERENCE TO GROUND; RESISTANCE READINGS TAKEN WITH SIMPSON MODEL 260; K=1000 OHMS; M=1,000,000 OHMS.
3. V1510 AND V1512 VOLTAGE READINGS TAKEN WITH OPERATION SELECTOR SWITCH IN CAL (CALIBRATE) POSITION; ALL OTHER READINGS TAKEN WITH SWITCH IN PHONE POSITION.
4. DO NOT ATTEMPT TO TAKE RESISTANCE READINGS FOR TRANSISTORS.
5. TRANSISTORS Q1503, Q1505 AND Q1506 ARE LOCATED ON FRONT PANEL.
6. FOR Q1503, PLACE AUDIO GAIN AND RF GAIN CONTROLS TO FULL CLOCKWISE POSITION.

7-39. Amplifier-Power Supply, Voltage and Resistance Chart

2-4 MC position, ANT. TRIM. control is at extreme counterclockwise position, and FREQUENCY dial is set to zero index mark.

Step 2. Check to see that tuning capacitor C1501 on rf head is fully meshed. This is observed by removing plug button, located above tube V1506, from side cut-out. Do not replace plug button until later. Position coupling MP1530 on C1501 shaft so that cap screws are facing plug button opening.

Step 3. Place rf head in main chassis. Examine mechanical alignment of C1501 shaft with dial drive shaft on front panel by viewing from side cut-out. If alignment is not exact, adjust the two height adjustment inserts with a 5/16-inch blade screwdriver. Inserts are located in front mounting holes. Slide coupling MP1530 so that it will be centered equally on both shafts. Coupling should slide easily. If not, adjust height adjustment inserts, as necessary.

Step 4. Replace and tighten four mounting screws. Check to see that coupling MP1530 slides easily on both shafts, if not, loosen mounting screws and readjust height adjustment inserts, then retighten mounting screws. Tighten cap screw of coupling MP1530 on C1501 shaft only.

Step 5. After replacement, check for proper dial calibration, as follows: Check that capacitor C1501 is set to a full mesh position. (It is possible that capacitor may have moved during replacement of rf head.) This is done by inserting a flat tool, such as a screwdriver blade, through plug opening and placing blade on top of stator plate assembly. Turn rotor assembly until it just touches tool at maximum capacity (full mesh). Continuing to hold tool against stator assembly, tighten remaining cap screw on coupling MP1530 while rotating allen wrench to produce a full mesh.

Step 6. Connect cables P1505 to J1513, P1502 to J1510, and P1506 to J1511. Replace antenna wire lead to terminal E1525, and wire leads from power supply to their proper terminals on terminal board TB1501. Replace plug button.

(c) INTERMEDIATE FREQUENCY AMPLIFIER.—The if. amplifier is a plug-in unit mounted on the underside of the receiver main chassis. (See figures 7–34, 7–40, 7–41 and 7–42.)

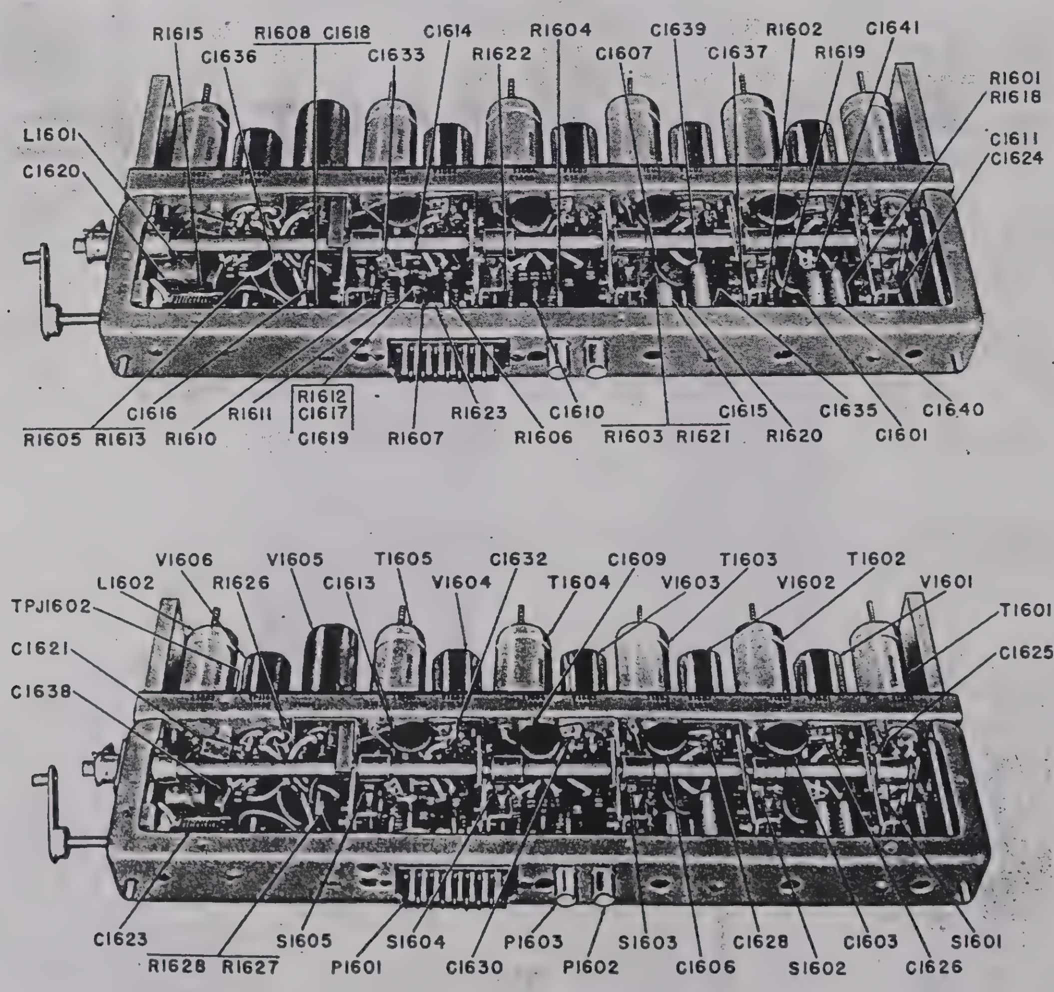


Figure 7–40. Intermediate Frequency Amplifier, Right Side View

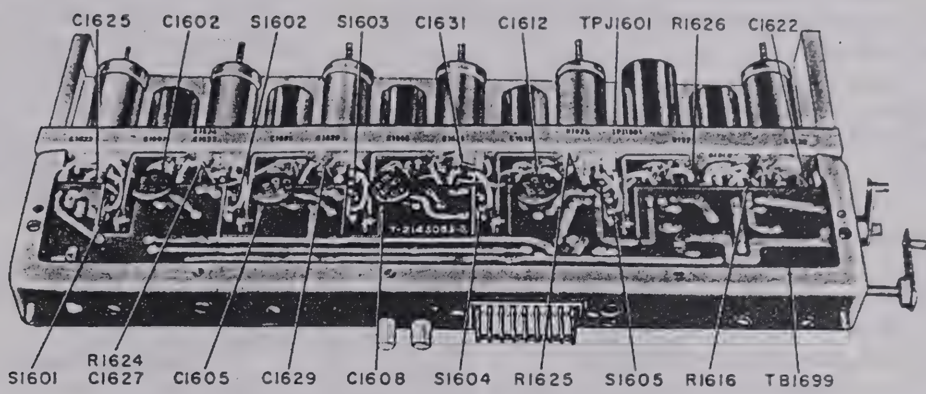
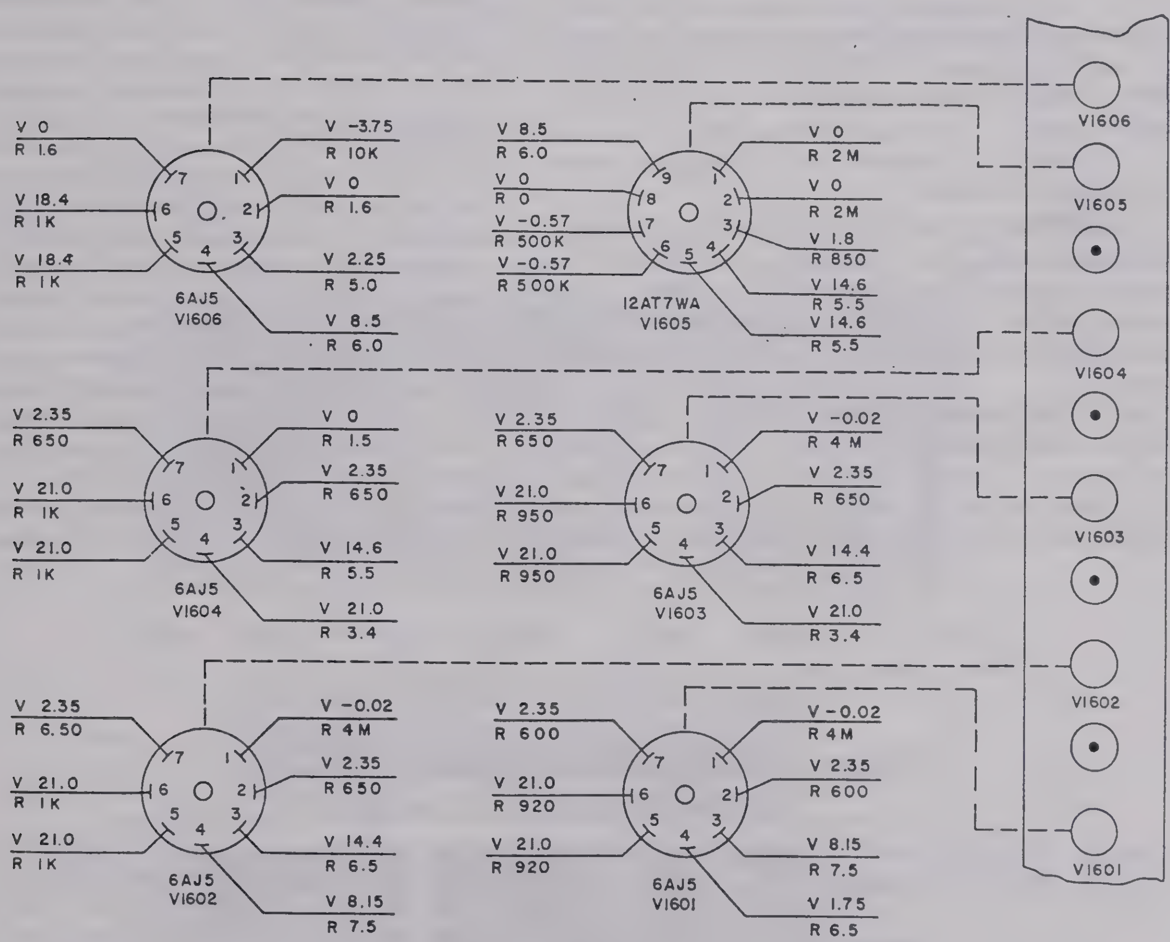


Figure 7-41. Intermediate Frequency Amplifier, Left Side View



NOTES
1. ALL VOLTAGES ARE POSITIVE DC VOLTAGES TAKEN WITH REFERENCE TO GROUND; VOLTAGES TAKEN WITH SIMPSON MODEL 260, AND MEASURED IN VOLTS.
2. ALL RESISTANCE READINGS TAKEN WITH REFERENCE TO GROUND; RESISTANCE READINGS TAKEN WITH SIMPSON MODEL 260; K = 1000 OHMS; M = 1,000,000 OHMS.
3. V1606 VOLTAGE READINGS TAKEN WITH OPERATION SELECTOR SWITCH IN CW, FSK BROAD POSITION; ALL OTHER READINGS TAKEN WITH SWITCH IN PHONE POSITION.

Figure 7-42. Intermediate Frequency Amplifier, Voltage and Resistance Chart

Step 1. Rotate BFO PITCH control to its full clockwise position, and place OPERATION SWITCH at CAL. position.

Step 2. Turn main chassis bottom side up, and remove cotter pins that secure link coupling to OPERATION SWITCH on front panel. Remove link coupling.

Step 3. Loosen two mounting screws holding subassembly to main chassis, and gently lift unit to disconnect P1601 from J1504. Then disconnect J1507 from P1603 and J1509 from P1602 and remove unit.

Step 4. To replace the if. amplifier in main chassis, reverse removal procedure.

(d) FREQUENCY SHIFT CONVERTER.—The fs converter is a plug-in unit mounted on the underside of the receiver main chassis. (See figures 7–34, 7–47, 7–48 or 7–34, 7–50, 7–51.)

Step 1. Loosen two mounting screws that secure the subassembly to the main chassis and gently lift unit to disconnect P1701 (or P1751) from J1505. Then disconnect J1508 from P1702 (or P1752) and remove unit.

Step 2. To replace the fs converter, reverse the removal procedure.

c. ELECTRICAL ADJUSTMENTS.—The following procedures outline the methods to be followed in making electrical adjustments and alignments in the receiver. Allow proper warm-up before performing any adjustments. (See table 7–1 for a list of test equipment.)

(1) AMPLIFIER-POWER SUPPLY ADJUSTMENTS. *(See figures 7–37, 7–38 and 7–84.)*—Connect a vtvm (dc) to terminal board TB1501, terminal 3 in rf head. Output at terminal 3 (voltage regulator output) shall be 21 volts dc, adjustable with R1564. Output of calibrator oscillator (V1512) shall be 200 kc. Connect a frequency counter to P1503, and adjust C1547 to obtain 200 kc.

(2) INTERMEDIATE FREQUENCY AMPLIFIER ADJUSTMENTS. *(See figures 7–40, 7–41 and 7–82.)*—It will be necessary to remove the if. amplifier subassembly for the following adjustments. Connect the subassembly to the main chassis by means of test cables.

The following test equipment will be required for alignment of the rf amplifier subassembly. (See table 7–1.)

1 rf signal generator
1 frequency counter
1 vtvm (dc)

(a) IF. TRANSFORMERS T1601 THROUGH T1605.—Disconnect if. input J1509 from P1602, and connect output from a signal generator to if. input through P1602. Connect a dc vtvm to the detector output at TP-J1601. Tune the signal generator to 455 kc and check with a frequency counter. The signal generator should be adjusted to produce a signal output level of approximately 2 volts (measured at TP-J1601). The first if. transformer (T1601) should be aligned first. The signal input should be progressively reduced as more circuits are brought into proper alignment (this keeps meter on scale) with progression of circuit adjustment moving toward the last if. stage. Each new if. transformer installed is aligned by first setting its upper and lower slugs to the full out (ccw) positions, then tuning the upper slug (primary) inward (cw) until a peak is observed on the vtvm, and then tuning the lower slug (secondary) inward (cw) to first peak. After new if. transformers have been adjusted, the remaining transformers should be peaked to bring if. sections into closer alignment.

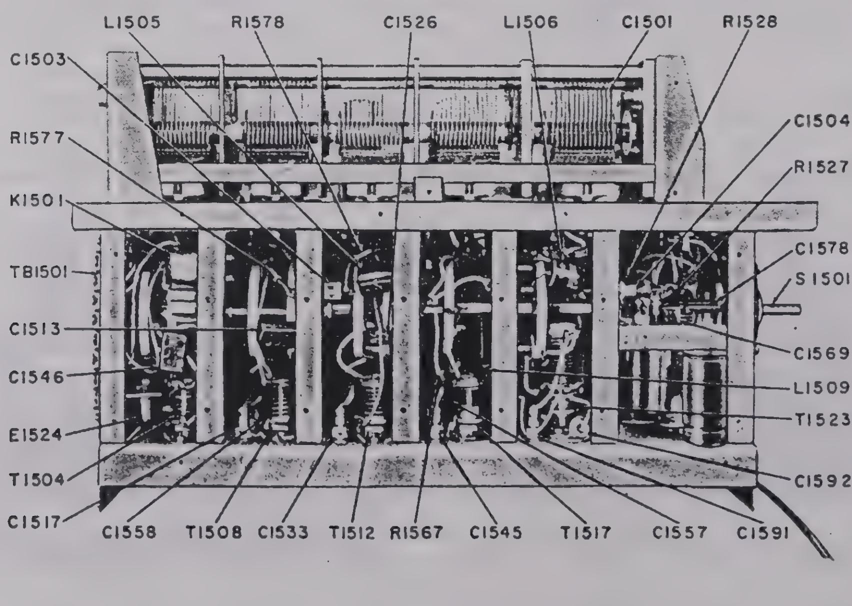


Figure 7–43. Radio Frequency Head, Left Side View

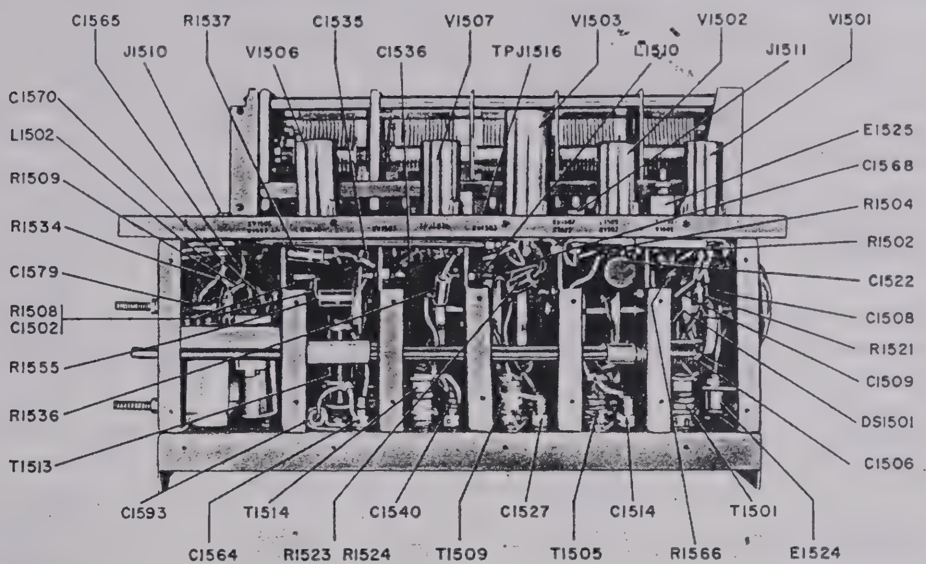


Figure 7–44. Radio Frequency Head, Right Side View

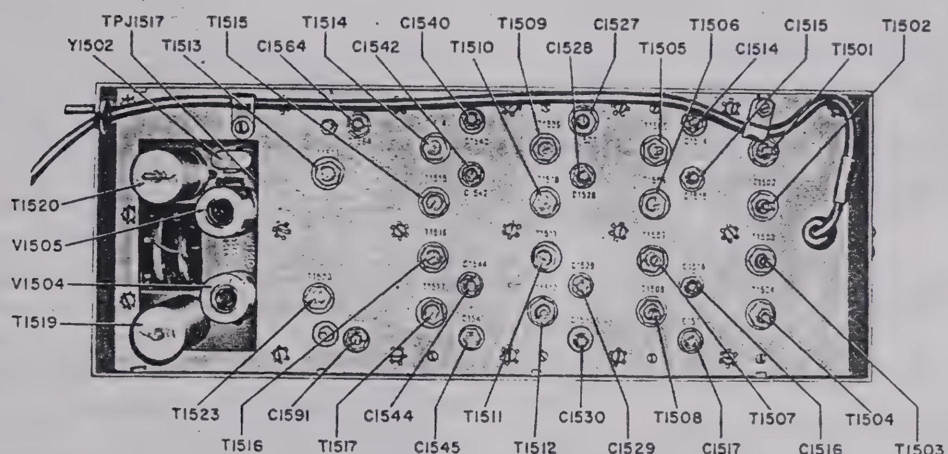


Figure 7–45. Radio Frequency Head, Bottom View

(b) BFO V1606.—Disconnect if. input J1509 from P1602. SET BFO PITCH adjust capacitor (C1623) to mid-point using front panel knob. Connect a frequency counter to plate (pin 6) of detector V1605AC, with tube V1605 removed. Adjust coil L1602 from maximum outward extension inward until frequency counter reads 455.0 kc. Full rotation of pitch adjust capacitor shall not cause a frequency change of less than 2.7 kc or more than 3.5 kc.

(3) RADIO FREQUENCY HEAD ADJUSTMENTS. *(See figures 7–43 through 7–46 and 7–80.)*— It will be necessary to remove the rf head from the main chassis for the following adjustments. Connect the subassembly to the main chassis by means of test cables.

The following test equipment will be required for alignment of the rf head. (See table 1–1):

1 vtvm (dc)
1 rf signal generator
1 frequency counter
1 dummy load
1 dummy antenna

(a) T1519 and T1520.—Connect a dc vtvm to detector output at TP-J1601. Connect a signal generator to grid of mixer at TP-J1516. Put switch S1501 in BAND 3 (8-16 mc) position. Set RF GAIN SQUELCH for approximately 0.5 volts (noise) at TP-J1601. Set signal generator to 1500 kc (check with frequency counter) and adjust signal generator output for approximately 2 volts at TP-J1601. Adjust T1519

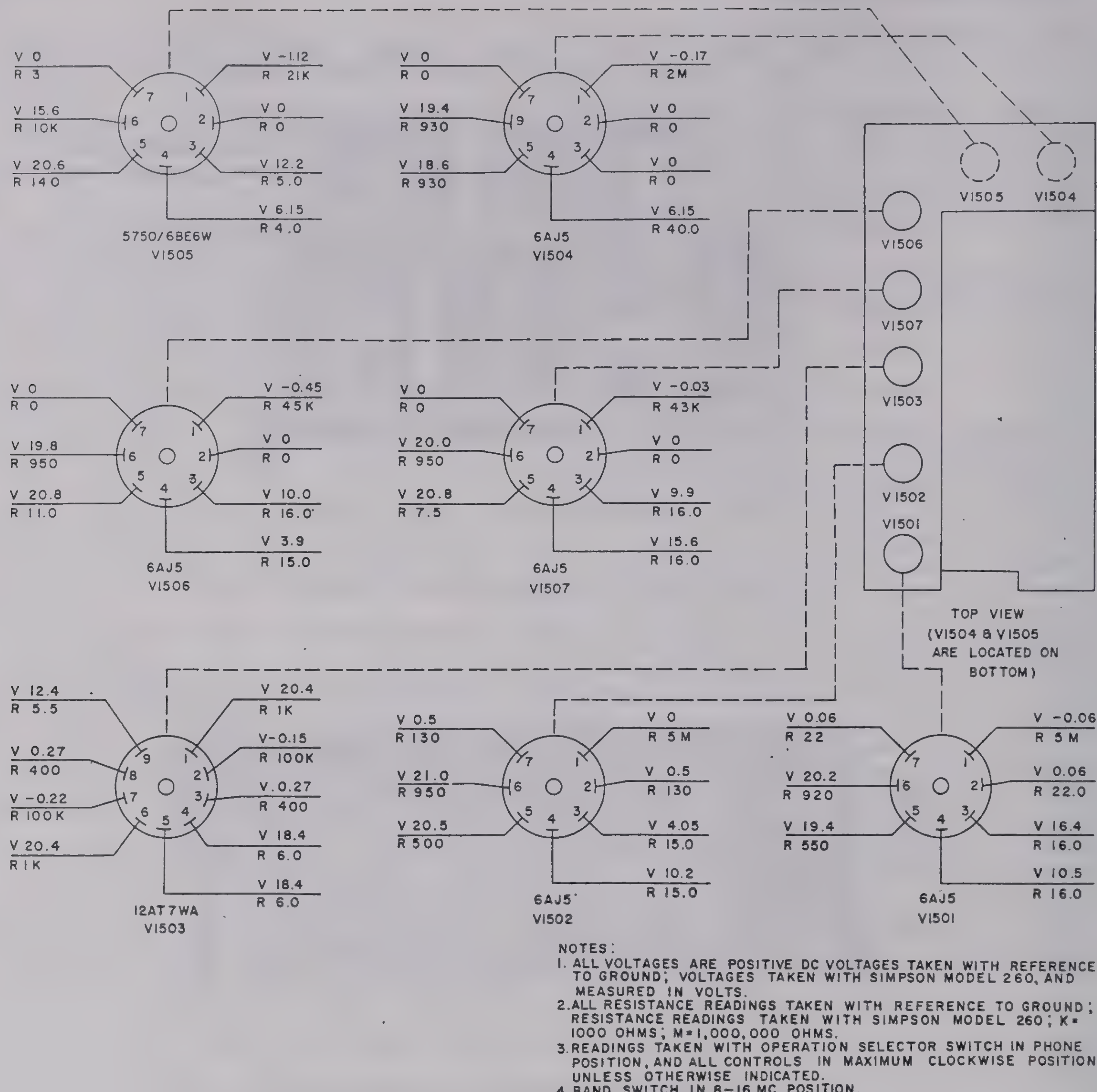


Figure 7–46. Radio Frequency Head, Voltage and Resistance Chart

and T1520 for maximum output by adjusting slugs from maximum outward extensions to first peak. Reduce generator output as coils are brought into alignment.

(b) LOCAL OSCILLATOR V1506 AND HARMONIC AMPLIFIER V1507.

1. PRELIMINARY STEPS.

Step 1. Disconnect antenna.

Step 2. Turn BFO off.

Step 3. Set OPERATION SWITCH to MCW.

Step 4. Set RF GAIN to half scale position.

Step 5. Set AUDIO GAIN control to maximum gain (fully cw).

Step 6. Disconnect signal generator and connect a frequency counter to TP-J1516.

2. BAND 1.

Step 1. Set BAND SWITCH (S1501) to BAND 1, 2-4 MC position.

Step 2. Set FREQUENCY dial (C1501) to read 2 mc.

Step 3. Turn all transformers and capacitors to full out position except those that were previously adjusted.

Step 4. Adjust transformer T1513 for 2.455 mc, indicated on frequency counter. (If unable to tune

to 2.455 mc, tune to closest frequency then go on to steps 5 through 8.)

Step 5. Adjust transformer T1514 for maximum dc output indicated on vtvm.

Step 6. Set FREQUENCY dial to 4.0 mc and adjust capacitor C1564 for 4.455 mc indicated on frequency counter. (If unable to tune to 4.455 mc, tune to closest frequency, then go on to steps 8 and 9.)

Step 7. Set FREQUENCY dial to 4.0 mc and adjust capacitor C1540 for maximum dc output indicated on VTVM.

Step 8. Repeat steps 4, 5, and 6 until frequency is correct and dc output is at maximum.

3. BAND 2.

Step 1. Set BAND SWITCH to BAND 2, 4-8 MC position. Set FREQUENCY dial to 4 mc.

Step 2. Tune transformer T1515 for maximum output, indicated on vtvm.

Step 3. Set FREQUENCY dial to 8 mc. Tune capacitor C1542 for maximum output, indicated on vtvm.

Step 4. Repeat steps 1 through 4 until maximum dc output is obtained.

4. BAND 3.

Step 1. Set BAND SWITCH to BAND 3, 8-16 MC position. Set FREQUENCY dial to 8.00 mc.

Step 2. Adjust transformer T1523 for 9.50 mc output indicated on frequency counter.

Step 3. Adjust transformer T1516 for maximum dc output indicated on vtvm.

Step 4. Set FREQUENCY dial to 16.00 mc.

Step 5. Adjust capacitor C1591 for 17.500 mc output indicated on frequency counter.

Step 6. Adjust capacitor C1544 for maximum dc output indicated on vtvm.

Step 7. Repeat steps 1 through 7 until frequency is correct.

5. BAND 4.

Step 1. Set BAND SWITCH to BAND 4, 16-32 mc position. Set FREQUENCY dial to 16 mc.

Step 2. Tune transformer T1517 for maximum output, indicated on vtvm.

Step 3. Set FREQUENCY dial to 30 mc. Tune capacitor C1545 for maximum output indicated on dc vtvm.

Step 4. Repeat steps 1 through 4 until maximum dc output is obtained.

(c) RF AMPLIFIER V1501, V1502.

1. PRELIMINARY STEPS.

Step 1. Repeat all preliminary steps listed under paragraph 7–5 *c* (3) *(b) 1.*

Step 2. Connect a dummy load to AUDIO OUTPUT.

Step 3. Connect a dummy antenna to ANT HI Z receiver input at E1519.

Step 4. Connect a signal generator to dummy antenna.

Step 5. Connect a dc vtvm to detector output at TP-J1601 (if. amplifier).

2. BAND 1.

Step 1. Set BAND SWITCH to BAND 1, 2-4 MC position, and dummy antenna to 2-8 mc.

Step 2. Set signal generator to 4 mc (check with frequency meter). Reduce output as signal tunes in.

Step 3. Rotate receiver FREQUENCY dial toward high end of band until input signal is received. Do not tune to image frequency that appears at twice the if. frequency (455 kc) above the signal expected.

Step 4. Peak antenna trimmer capacitors C1506, C1514, C1527, for maximum audio output indicated on vtvm.

Step 5. Set signal generator to 2.00 mc output.

Step 6. Rotate FREQUENCY dial toward low end of band until input signal is indicated on vtvm (maximum signal slightly above or below 2 mc).

Step 7. Adjust transformers T1501, T1505, and T1509 for maximum audio output indicated on vtvm. Tune transformer T1501 to first peak found from fully extended out position. Tune transformer T1505 to second peak found from fully extended out position. Tune transformer T1509 to first peak found from fully extended out position.

Step 8. Repeat steps through 7 until maximum audio output is obtained.

3. BAND 2.

Step 1. Set BAND SWITCH to BAND 2, 4-8 MC position.

Step 2. Set signal generator for 8 mc output.

Step 3. Rotate FREQUENCY dial toward high side of band until input signal is indicated on vtvm (maximum signal slightly above or below 8 mc).

Step 4. Peak trimmer capacitors C1506, C1515, C1528 for maximum audio output indicated on vtvm.

Step 5. Set signal generator to 4 mc output.

Step 6. Rotate FREQUENCY dial toward low end of band until input signal is indicated on vtvm (maximum signal slightly above or below 4 mc).

Step 7. Adjust transformers T1502, T1506, T1510 for maximum audio output indicated on vtvm.

Step 8. Repeat steps 2 through 7 until maximum audio output is obtained.

4. BAND 3.

Step 1. Set BAND SWITCH to BAND 3, 8-16 MC position and dummy antenna to 8-16 mc.

Step 2. Set signal generator to 16 mc output.

Step 3. Rotate FREQUENCY dial toward the hig' end of band until input signal is indicated on vtvm (maximum signal slightly above or below 16 mc).

Step 4. Peak trimmer capacitors C1506, C1516, C1529 for maximum output indicated on vtvm.

Step 5. Set signal generator to 8 mc output.

Step 6. Rotate FREQUFNCY dial toward the low end of band until input ..gnal is indicated on vtvm (maximum signal slightly above or below 8 mc).

Step 7. Adjust transformers T1503, T1507, T1511 for maximum output indicated on vtvm.

Step 8. Repeat steps 2 through 7 until maximum audio output is obtained.

5. BAND 4.

Step 1. Set BAND SWITCH to BAND 4, 16-32 MC position and dummy antenna to 16-32 mc.

Step 2. Set signal generator to 30 mc output.

Step 3. Rotate FREQUENCY dial toward the high end of band until input signal is indicated on vtvm (maximum signal slightly above or below 30 mc).

Step 4. Peak trimmer capacitors C1506, C1517, C1530, for maximum output indicated on vtvm.

Step 5. Set signal generator to 16 mc output.

Step 6. Rotate FREQUENCY dial toward the low end of band until input signal is indicated on vtvm (maximum signal slightly above or below 16mc).

Step 7. Adjust transformers T1504, T1508, T1512 for maximum output indicated on vtvm.

Step 8. Repeat steps 2 through 7 until maximum audio output is obtained.

(4) FREQUENCY SHIFT CONVERTER, AF TYPE ALIGNMENT. *(See figures 7–47 through 7–49, and 7–86.)*

The following test equipment will be required for alignment of the fs converter, af type. (See table 7–1):

1 rf signal generator
1 frequency counter
1 vtvm (dc)

(a) IF. TRANSFORMERS T1701 and T1702. —It will be necessary to remove the fs converter for the following adjustments. Connect P1701 to J1505 on the main chassis by means of a test cable.

Step 1. Connect output from signal generator to if. input through P1702.

Step 2. Tune signal generator to 455 kc (unmodulated) at 0.5 volt output. Check with a frequency counter.

Step 3. Connect a dc vtvm between TP-J1702 and ground. Select a sensitive scale. There should be a negative output voltage.

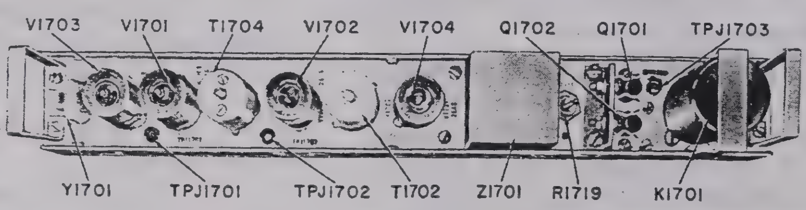


Figure 7–47. Frequency Shift Converter, AF Type, Top View

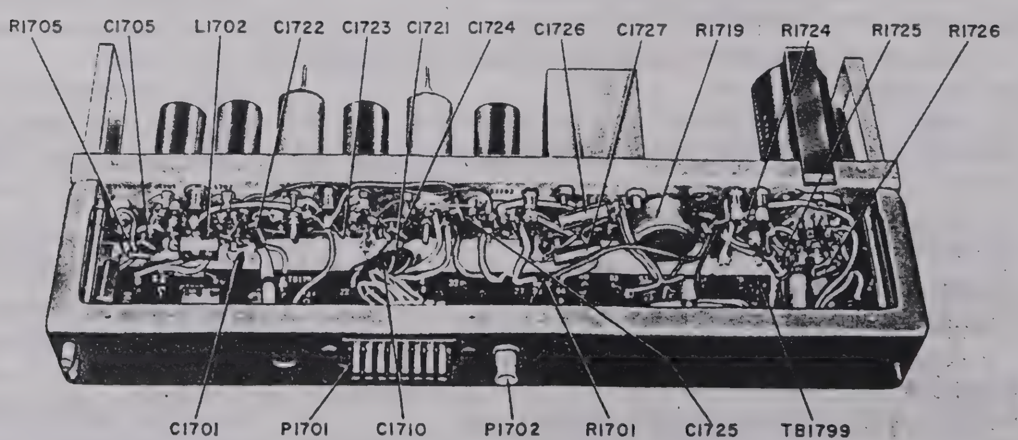


Figure 7–48. Frequency Shift Converter, AF Type, Side View

Step 4. Remove crystal Y1701, then adjust top and bottom slugs of T1701 and T1702 for maximum dc output. Top slugs should be set to first tuning peak reached, start by setting slug to full out (ccw) position. It may be necessary to feed in a large signal at first and observe output at TP-J1701 to peak T1701.

Step 5. After T1701 and T1702 are peaked, repeat adjustments until a maximum output has been obtained.

Step 6. Replace crystal Y1701 and disconnect signal generator.

(b) BIAS ADJUST CONTROL R1719.—It will not be necessary to remove the fs converter from the main chassis for this adjustment.

Step 1. Remove antenna input to receiver.

Step 2. Set OPERATION SWITCH to CW/FSK BROAD position and HOLD-OPERATE switch to OPERATE position.

Step 3. Adjust potentiometer R1719 for a zero reading on TELETYPE TUNING meter M1501.

An alternate method for adjusting R1719 is as follows: With antenna connected to receiver and during reception of space and mark signals, meter M1501 should deflect to one side during mark condition and deflect to the opposite side during space condition. If necessary, adjust R1719 for equal deflection to either side of zero of meter M1501.

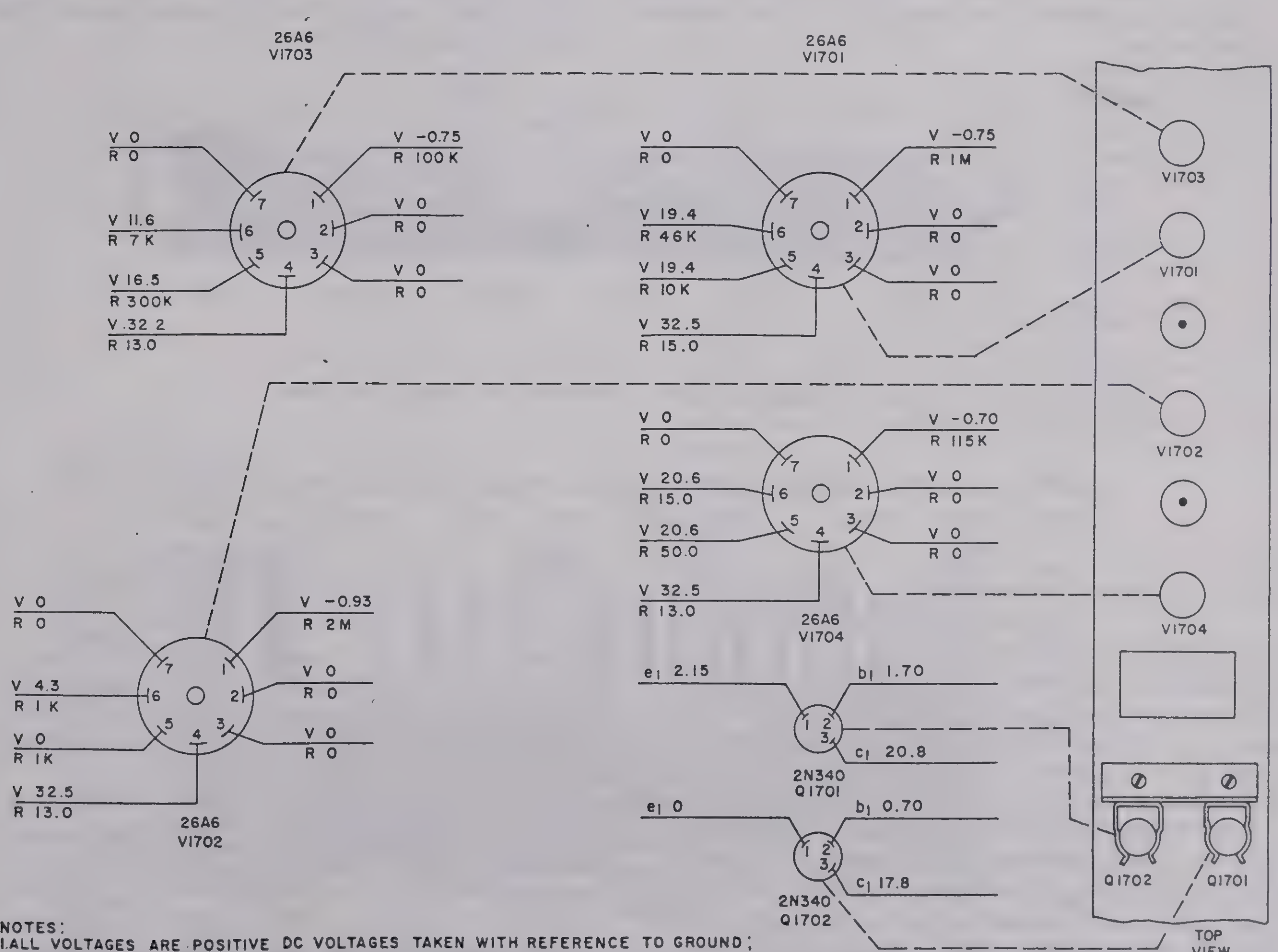
(5) FREQUENCY SHIFT CONVERTER, IF. TYPE ALIGNMENT. *(See figures 7–50 through 7–52, and 7–88.)*

The following test equipment will be required for alignment of the fs converter, if. type. (See table 7–1):

1 rf signal generator
1 vtvm (dc)

(a) IF. TRANSFORMERS T1751 and T1752.—It will be necessary to remove the fs converter for the following adjustments. Connect P1751 to J1505 on the main chassis by means of a test cable.

Step 1. Connect output from a signal generator to if. input through P1752.



NOTES:
1. ALL VOLTAGES ARE POSITIVE DC VOLTAGES TAKEN WITH REFERENCE TO GROUND; VOLTAGES TAKEN SIMPSON MODEL 260, AND MEASURED IN VOLTS.
2. ALL RESISTANCE READINGS TAKEN WITH REFERENCE TO GROUND; RESISTANCE READINGS TAKEN WITH SIMPSON MODEL 260; K=1000 OHMS; M=1,000,000 OHMS.
3. READINGS TAKEN WITH OPERATION SELECTOR SWITCH IN FSK, PHONE POSITION, AND ALL CONTROLS IN MAXIMUM CLOCKWISE POSITION, UNLESS OTHERWISE INDICATED.
4. DO NOT ATTEMPT TO TAKE RESISTANCE READINGS FOR TRANSITORS.

Figure 7–49. Frequency Shift Converter, AF Type, Voltage and Resistance Chart

Step 2. Set signal generator to 455 kc ±50 cycles, 10 k microvolt, unmodulated output.

Step 3. Connect vtvm to TP-J1754 and adjust top and bottom slugs of T1751 for maximum dc output. Tune to first peak from full counterclockwise position.

Step 4. Connect vtvm to TP-J1755 and adjust top and bottom slugs of T1752 for maximum dc output. Reduce generator input voltage as T1751 and T1752 are peaked. Tune to first peak from full counterclockwise position.

(b) DISCRIMINATOR TRANSFORMER T1753.—The alignment of T1753 follows the alignment of T1751 and T1752.

Step 1. With fs converter removed from main chassis and connected by means of test cables, connect signal generator to if. input P1752.

Step 2. Set signal generator to 454 kc ±50 cycles, 500 microvolts, unmodulated output.

Step 3. Connect vtvm to terminal B of T1753 and adjust primary (top slug) of T1753 for maximum dc output.

Step 4. Set signal generator to 455 kc ±50 cycles, 100 k microvolts, unmodulated output.

Step 5. Set vtvm to 5 volt dc scale and connect vtvm to TP-J1752. Adjust secondary (bottom slug) of T1753 for zero volts.

Step 6. Adjust R1769 for zero, as indicated on TELETYPE TUNING METER M1501.

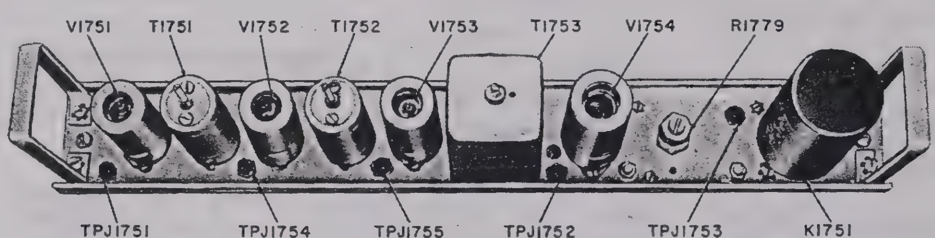
(c) BIAS ADJUST CONTROL R1779.—This potentiometer is a balance adjustment for relay K1751.

Step 1. Disconnect signal generator from P1752 and connect J1508 to P1752 by means of a test cable.

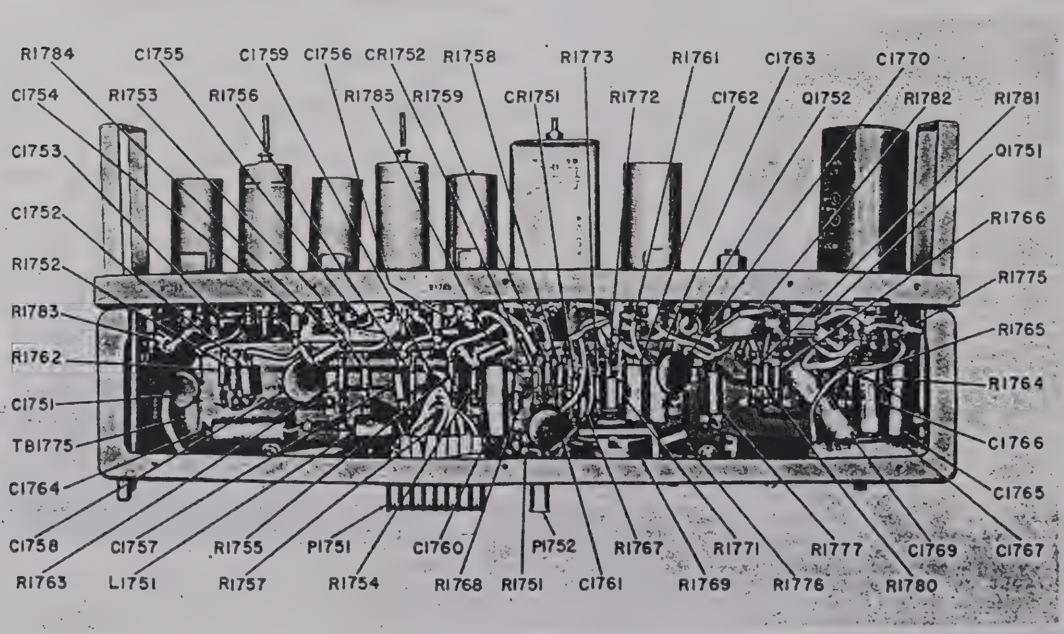
Step 2. Use a vtvm to take voltage readings at pins 3 and 8 of relay K1751. The voltage readings at these points should be equal; if they are not, adjust R1779 until voltages are equal.

Step 3. Tighten locking nut on R1779.

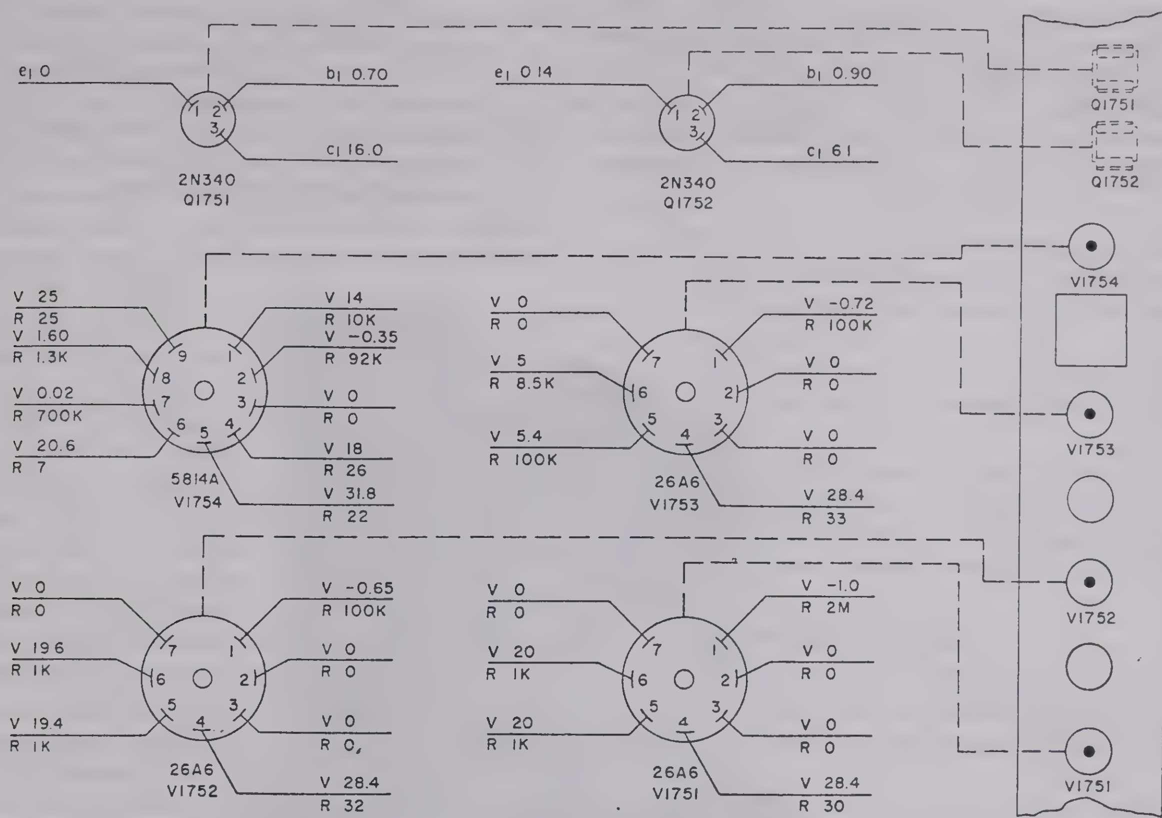
An alternate procedure for obtaining a balance for relay K1751 is to connect a 50-0-50 microammeter between terminals 3 and 8 of K1751. Across these same terminals connect a 22 ohm, 1 watt resistor. Adjust R1779 for a zero reading on microammeter. Tighten locking nut on R1779.



7–50. Frequency Shift Converter, IF. Type, Top View



7–51. Frequency Shift Converter, IF. Type, Side View



NOTES
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2. ALL RESISTANCE READINGS TAKEN WITH REFERENCE TO GROUND; RESISTANCE READINGS TAKEN WITH SIMPSON MODEL 260; K=1000 OHMS; M=1,000,000 OHMS.
3. READINGS TAKEN WITH OPERATION SELECTOR SWITCH IN FSK, PHONE POSITION, AND ALL CONTROLS IN MAXIMUM CLOCKWISE POSITION, UNLESS OTHERWISE INDICATED.
4. DO NOT ATTEMPT TO TAKE RESISTANCE READINGS FOR TRANSISTORS.

Figure 7-52. Frequency Shift Converter, IF. Type, Voltage and Resistance Chart

d. CRYSTAL DATA.

(1) GENERAL.—The receiver uses 3 crystals. The crystals are in the rf head subassembly, amplifier-power supply subassembly and the af type frequency shift converter. The following circuits are crystal controlled. (Refer to figures 7-80, 7-84, and 7-86.)

(a) CONVERTER V1505. — Quartz crystal Y1502 has a resonant frequency of 1955 kc, which heterodynes with the 1500-kc if. signal generated during operation on bands 3 and 4. As a result, a 455-kc if. signal is produced. The converter stage is inoperative during operation on bands 1 and 2.

(b) CALIBRATOR OSCILLATOR V1512. — Quartz crystal Y1501 has a resonant frequency of 200 kc. The output from oscillator tube V1512 is applied to harmonic amplifier V1510 to generate harmonics of the 200-kc signal. The high harmonic output of V1510 is applied to the rf head subassembly to calibrate the receiver main tuning dial. The V1512 and V1510 stages are only operative in the CAL. position of the OPERATION SWITCH.

(c) BEAT FREQUENCY OSCILLATOR V1703. — Quartz crystal Y1701 has a resonant frequency of 452.5 kc, which heterodynes with the 455 kc $\pm$ Δf space and mark teletype signals. As a result, audio frequencies of approximately 2 to 3 kc are produced. BFO stage V1703 is operative only in the FSK positions of the OPERATION SWITCH.

(2) CRYSTAL CHARACTERISTICS.—Y1502 is a type CR-18/U crystal which is hermetically sealed in a type HC-6/U crystal holder. The crystal has an accuracy of $\pm$0.005 percent throughout its operating temperature range of -55 degrees to $+90$ degrees C.

Y1501 and Y1701 are type CR-46/U crystals and are hermetically sealed in type HC-6/U crystal holders. The crystals have an accuracy of $\pm$0.01 percent throughout an operating temperature range of -40 degrees to $+70$ degrees C.

(3) CRYSTAL HOLDER CHARACTERISTICS. —The crystal holders used with Y1502, Y1501, and Y1701 are type HC-6/U. The crystal holders have the following physical dimensions: length 0.750 inch; width 0.345 inch; height 0.765 inch (less pins); number of pins 2; spacing of pins 0.486 inch; and diameter of pins 0.050 inch. The crystals are wire-mounted in the metal crystal holders.

7–6. CONTROL GROUP.

a. GENERAL.—The control group is composed of a local remote control, which is operated from within the vehicle, and a field remote control, which is usually operated from a remote site. The local remote control serves as a junction for the field remote control. Therefore a failure in the local remote control will usually disable the field remote control.

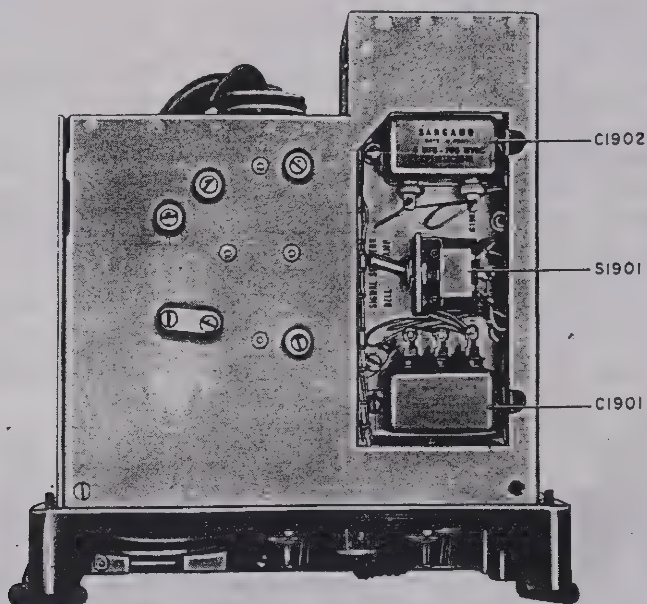


Figure 7–53. Local Remote Control, Top View

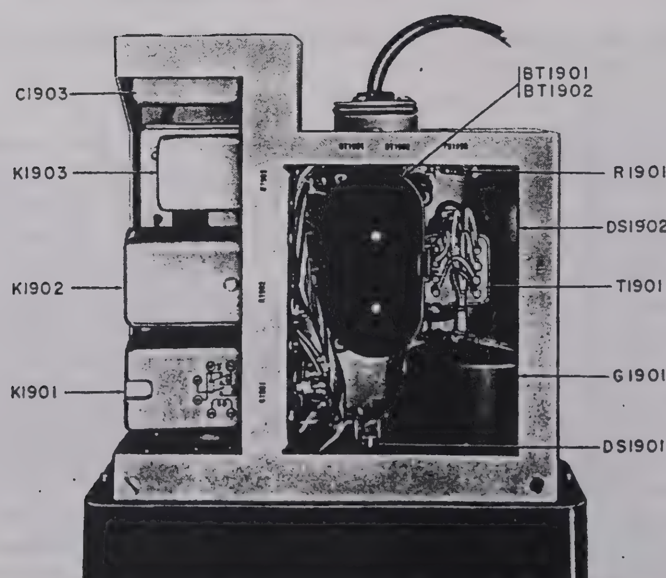


Figure 7–54. Local Remote Control, Bottom View

There are no electrical adjustments at either of the control units. Troubleshooting of the units should be accomplished with a multimeter and with the aid of the control group troubleshooting chart (table 7–8). If trouble cannot be localized by means of the checks listed in the table, the technician should adopt a systematic procedure to localize the trouble. Continuity and voltage checks can be made using the schematic diagrams as a guide. (See figures 7–53 through 7–56 and 7–90 through 7–93.)

Failure of the control units will usually be caused by defective batteries. The field remote control uses two 1-1/2-volt batteries (type BA-30) and one 45-volt battery (type BA-414/U). The local remote control uses two 1-1/2-volt batteries (type BA-30).

b. BATTERY REPLACEMENT. *(Refer to figures 7–54 and 7–56.)*—To remove the two 1-1/2-volt batteries from the local remote control, first remove the control unit chassis from the cabinet by loosening the front panel captive screws. Access to the batteries is gained by depressing the latch on the battery compartment cover and removing the cover.

To remove the two 1-1/2-volt batteries and the 45-volt battery from the field remote control, remove the control unit chassis from the cabinet by unlocking the two front panel latches. The 1-1/2-volt batteries are located under the battery cover. To remove the 45-volt battery, disconnect the octal connector and remove the battery.

c. HAND RINGING GENERATOR REPLACEMENT.—The local remote control and field remote control units have similar hand ringing generators, G1901 and G2001, respectively. The procedures for both generator units are the same.

Step 1. Remove remote control chassis from its enclosure.

Step 2. Remove handwheel from generator by removing handwheel retaining screw and lockwasher.

Step 3. Unscrew and remove generator mounting nut from front panel.

Step 4. Unsolder and remove the five wires from the three terminals on generator. Note location of wires.

Step 5. Slide generator out from behind front panel, and lift from remote control chassis.

Step 6. To replace the hand ringing generator within the remote control chassis, reverse the removal procedure.

7–7. GENERATOR SYSTEM.

a. TROUBLE LOCATION.—When trouble occurs in the vehicular generator system, the following procedure will help to localize the trouble. (See figure 7–94.):

Step 1. Stop engine and determine that all cables are connected properly and securely.

Step 2. Check wiring for frayed insulation or breaks.

TABLE 7–8. CONTROL GROUP TROUBLESHOOTING CHART

TROUBLE	SYMPTOMS	PROBABLE CAUSE	CORRECTIVE ACTION
No AM or CW/FSK operation possible from field remote control.	Operation possible in TEL position.	Defective battery BT2003 in field remote control.	Replace BT2003.
No output from field remote control in AM, CW/FSK or TEL operation.	Ringing circuits operate, and reception on phones is possible.	Contacts in ringer G2001.	Replace or repair ringer G2001.
		Microphone defective.	Replace microphone.
No control of dynamotor by field remote control in CW/FSK operation.	Operation in AM and TEL is possible.	Latching relay K1902 in local remote control.	Replace relay K1902.
No control of dynamotor by field remote control in AM operation.	Field remote control operates in CW/FSK and TEL.	Relay K1901 in local remote control.	Replace relay K1901.
	Local remote control operates in AM.	Push-to-talk switch in handset.	Replace or repair.
No CW operation possible from field remote control.	Operation possible in AM and TEL service, and field remote control can turn dynamotor on and off.	Keying relay K1903.	Replace relay K1903.
No operation in TEL service.	Ringing between units is possible, and field remote control operates in AM and CW/FSK.	Defective batteries BT1901, BT1902 or BT2001, BT2002.	Replace defective batteries.

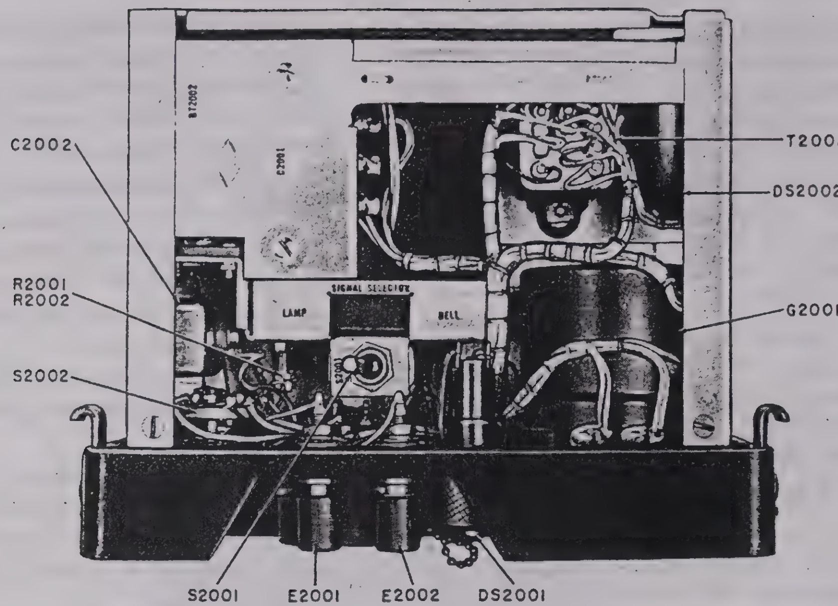


Figure 7–55. Field Remote Control, Top View

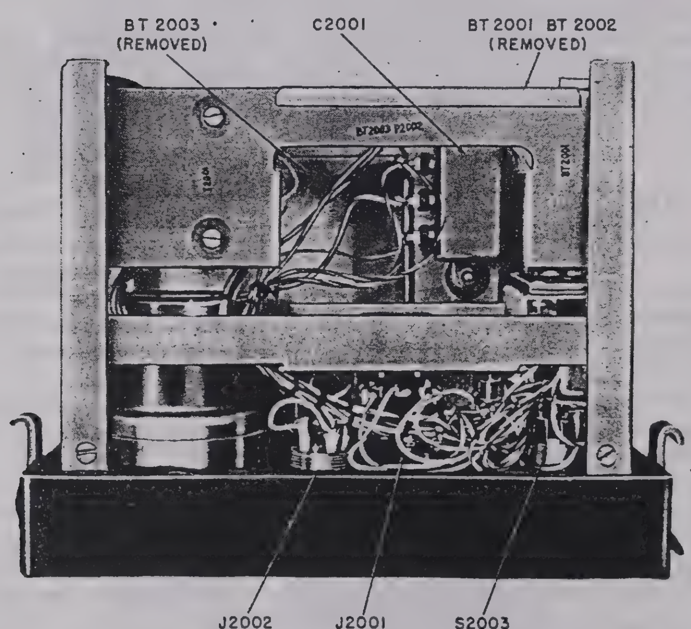


Figure 7–56. Field Remote Control, Bottom View

Step 3. Check fan belts for proper tension.

Step 4. Check that contacts of the load relay in regulator box close when the ignition switch is turned on.

Step 5. If generator system still fails to operate, remove cable between alternator and rectifier, and cable between rectifier and regulator.

Step 6. Use an ohmmeter to check for cable continuity. (Refer to the generator system interconnecting diagram, (figure 3–14).

Step 7. If cables are found to be satisfactory, fault may lie in regulator. If possible, substitute with another regulator known to be in good working order, and perform necessary regulator adjustments as described in paragraph 7–7 *b* (1).

Step 8. If, after replacing regulator in vehicle, generator system still does not operate, check and, if necessary, replace alternator. Refer to paragraph 7–7 *b* (2) for electrical checks of the alternator unit to be made before replacing the unit.

Step 9. If, after replacing alternator in vehicle, generator system still does not operate, replace power rectifier. Damaged plates in rectifier unit are an indication of a faulty rectifier. Refer to paragraph 7–7 *b* (3) for electrical checks of rectifier unit.

Note

Procedure for the removal and replacement of the regulator, alternator and rectifier units is given in section 3 (Installation).

b. REPAIR AND ADJUSTMENTS.

(1) REGULATOR UNIT.—The output of the generator system may be adjusted to 27.5-volts dc, as follows:

Step 1. Remove all loads from generator system, with exception of vehicular batteries.

Step 2. Connect a voltmeter across battery terminals.

Step 3. Start engine and permit it to operate slightly above idling speed. After a few minutes of operation, the voltmeter should indicate 27.5 to 28 volts.

Step 4. If necessary, adjust output voltage to 27.5 volts by means of VOLTAGE ADJUST rheostat located on regulator unit. To gain access to adjustment, remove plug cover on top or front side of regulator.

(2) ALTERNATOR UNIT.—In the event of trouble with the alternator, the following electrical checks and repairs may be performed. The engine must be shut off for these checks.

(a) STATOR WINDING CONTINUITY.—Disconnect the cable between the alternator and the rectifier. With an ohmmeter, check the continuity across the A-B, B-C, and A-C pins of the alternator output connector. Each check must show a closed circuit or low resistance.

(b) GROUND TEST. — With an ohmmeter, check from ground (frame) to pins A-B-C-D-E of the alternator output connector. No circuit should be present. Replace the cable between the alternator and the rectifier.

(c) REPLACEMENT OF BRUSHES.—The slip ring brushes of the alternator may be inspected and replaced, if necessary, as follows:

Step 1. Remove slip ring end fan to check brushes.

Step 2. Check slip ring brushes for wear and a free, smooth fit in brush holders. Worn brushes are indicated when brush length is 5/16 inch, or one-half the length of a new brush.

Step 3. Disconnect two flexible jumpers from brush rigging studs.

Step 4. Hold brush levers clear of the brushes and remove brushes.

Step 5. To insert new brushes, reverse removal procedure described in steps 1 through 4.

(d) FIELD COIL (ROTOR) RESISTANCE CHECK.—Connect an ohmmeter across the two slip rings. The ohmmeter test prods must make direct contact with the slip rings. The rotor winding resistance should measure approximately 1.7 ohms.

Note

Rotor coil resistance measurement made at the connector pins or at the brush levers will be inaccurate because of variations in brush-to-slip ring contact resistance.

(3) RECTIFIER UNIT. — The following procedure is an electrical check on the performance of the power rectifier unit:

Step 1. Remove cable between alternator and rectifier (input), and cable between rectifier and regulator (output).

Step 2. Connect a 25-ampere load in series with an ammeter across pins C-D of output connector.

Step 3. Connect test prods to a fully charged 28-volt battery and make the following checks across pins A, B, and C of the input connector. The ammeter readings should be approximately equal for all measurements.

POSITIVE BATTERY TERMINAL TO	NEGATIVE BATTERY TERMINAL TO
A	B
B	A
B	C
C	B
A	C
C	A

7–8. EMERGENCY MAINTENANCE.

a. GENERAL.—Fuse and electron tube failure will be the most likely and most frequent causes of trouble. Refer to section 5 for fuse and electron tube locations and general information.

b. ELECTRON TUBES.—Table 5–5, and the illustrations in Section 7, will aid in locating and identifying the tubes, transistors and diodes within the subassemblies of the Radio Set AN/MRC–55. Table 7–9 lists the rated characteristics of all types of tubes used in the radio set. These data do not represent maximum operating conditions or rated operating conditions; they represent the conditions under which the tubes were tested.

c. VOLTAGE AND RESISTANCE CHARTS.—Typical voltage and resistance measurements are given

for all subassemblies. See the list of illustrations for the figure number and location of the applicable chart.

d. WINDING DATA.—Table 7–10 lists the wire-wound electrical components used in Radio Set AN/MRC–55, and gives data pertinent to them to facilitate emergency repairs in the field.

The components in the following list are not included in table 7–10.

Encapsulated Coils

L713	L1405
L714	L1502
L901	L1505
L902	L1506
L1002	L1509
L1006	L1510
L1008	L1511
L1009	L1601
L1013	L1701
L1202	L1702
L1404	L1751

Hermetically Sealed Components

T901	T1402
T1002	L1507
T1101	T1518
T1102	T1521
L1401	T1522
L1402	T1901
L1406	T2001
L1407	Z1701

All wires listed in table 7–10 are AWG copper wire unless otherwise specified. The designations listed along with the wire size identify the wire type as follows:

E—enamel
F2—double fiber synthetic
R2—double resin
ESN—silk covered enamel
DSC—double silk covered
DN—double nylon

In the "Diagram" column of Table 7–10, the numerals refer to items on the page of diagrams included at the end of the table.

The two impregnation methods for moisture and fungus proofing of coils follow:

Notes

1. Inside diameter of coil form and all threads shall be masked during impregnation.
2. Mixed varnish shall be a mixture of 100 parts of Insulex No. 85-IT varnish to 86 parts thinner No. 80, or equivalents.
3. All varnish shall be moisture and fungus-resistant per MIL-V-173A.
4. Inductance shall be measured on Boonton 160-A Q meter. In the case of two winding coils, the winding not under test shall be short circuited with a wire across the leads.
5. Mutual inductance (M) measured after secondary has been adjusted:
   Aiding: terminals 2 and 3 connected together; measurement between terminals 1 and 4.
   Opposing: terminals 3 and 4 connected together; measurement between terminals 1 and 2.

(1) IMPREGNATION METHOD 1.

Step 1. Clean all surfaces of coil form with dry cleaning solvent P-S-661lb. Bake for 1/2 hour at 100°C (212°F). Remove from oven and allow to cool to room temperature.

Step 2. Wind coil. Bake for 1 hour at 100°C (212°F). Remove from oven and allow to cool to 55° to 66°C (130° to 150°F).

Step 3. Brush on mixed varnish. Air dry for 10 minutes. Bake for 1 hour at 100°C (212°F). Remove from oven and allow to cool to 55° to 66°C (130° to 150°F).

Step 4. Repeat step 3.

(2) IMPREGNATION METHOD 2.

Step 1. Apply one coat of coil dope (Amphenoe Polyweld 912, or equivalent).

Step 2. Air dry for three hours.

Step 3. Repeat steps 1 and 2.

TABLE 7–9. TUBE CHARACTERISTICS

TUBE TYPE	FILAMENT VOLTAGE (V)	FILAMENT CURRENT (Amp)	PLATE VOLTAGE (V)	GRID BIAS	SCREEN VOLTAGE (V)	PLATE CURRENT (MA)	SCREEN CURRENT (MA)	AC PLATE RESIST-ANCE (Ohms)	VOLTAGE AMPLIFI-CATION FACTOR (MU)	TRANSCONDUCTANCE (Micromhos)		EMISSION	
										NORMAL	MINIMUM	IS (MA)	TEST VOLTAGE
4X250F	26.5	0.50	1000	−50	350	100 min 250 max	25 max	3260	5	12000		Ib = 200	Eb = 500
6AH6	6.3	0.450	150(1) 300(2)	0	150	12.5(1) 10(2)	2.6	3600(1) 500k(2)	40(1)	8500	6000	40 min	10
6AJ5	6.3	0.175	28		28	2.9	1.05		250	2750	2000		
6CL6	6.3	0.65	250	−3	150	30	7	90k		11600	9200	180 min	20
12AT7WA	12.6	0.15	100*	−5*		3.7*		15k*	60*	4000*			
12BA6	12.6	0.15	250	−20	100	11	4.2	1 mego		4400	3600	60 min	20
26A6	26.5	0.70	26.5	0	26.5	1.6	0.65			1950	1200	50 min	15
5651	DC Starting Voltage 115 v min DC Operating Voltage 87 v			Operating Current 1.5 ma min 3.6 ma max				Regulation 3 vdc Stability 0.1 vdc					
5654/ 6AK5W	6.3	0.175	120	−2	120	7.5	2.5	300k		5000	3750		
5687WA	12.6	0.9	120*	−2*		36*			17.75*	11000*	8000*	125 min*	15*
5725/ 6AS6W	6.3	0.175	120	2	120	5.2	3.5	150k		3200	2500		
5750/ 6BE6W	6.3	0.35	250		100	2.5	7.6	1 mego		500	430		
5751/ 5751WA	12.6	0.175	250*	−3		1.0*			70	1200*	900*		
5814A	12.6	0.175	250*	−8.5*		10.5*		6250*	19.5*	2200*	1750*		
6005/ 6AQ5W	6.3	0.45	250	−12.5	250	45	4.5	52k	45	4100	3000		
6082	26.5	0.6	135	−7		125		280	2	7000	5800		

Notes: *Each Section (1) Triode Connection (2) Pentode Connection

TABLE 7–10. WINDING DATA

DESIGNATION SYMBOL	PART NUMBER	DIAGRAM	WINDING	WIRE SIZE	TURNS	D-C RESISTANCE (Ohms)	REMARKS
L101	C2145074G1	1	1 single layer, cw	26R2	11		1.19 μh nom at 20 mc, slug tuning; min Q90; impregnate method 1.
L102	C2145074G2	1	1 single layer, cw	22R2	11		0.58 μh nom at 21 mc; slug tuning; min Q90; impregnate method 1.
L103	C2145074G3	1	1 single layer, cw	21R2	9		0.49 μh nom at 22 mc; slug tuning; min Q90; impregnate method 1.
L104	C2145074G4	1	1 single layer, cw	21R2	9		0.43 μh nom at 23 mc; slug tuning; min Q90; impregnate method 1.
L105	C2145074G5	1	1 single layer, cw	21R2	8		0.38 μh nom at 24 mc; slug tuning; min Q90; impregnate method 1.
L106	C2145074G6	1	1 single layer, cw	20R2	7		0.34 μh nom at 25 mc; slug tuning; min Q90; impregnate method 1.
L107 L108	C2145074G7	1	1 single layer, cw	20R2	7		0.30 μh nom at 26 mc; slug tuning; min Q90; impregnate method 1.
L109 L110	C2145074G8	1	1 single layer, cw	20R2	6		0.27 μh nom at 27 mc; slug tuning; min Q90; impregnate method 1.
L111	C2145074G11	1	1 single layer, cw	26R2	18		1.6 μh nom at 10 mc; slug tuning; min Q70; impregnate method 1.
L112	C2145074G12	1	1 single layer, cw	25R2	16		1.3 μh nom at 11 mc; slug tuning; min Q80; impregnate method 1.
L113	C2145074G13	1	1 single layer, cw	25R2	16		1.2 μh nom at 12 mc; slug tuning; min Q80; impregnate method 1.
L114	C2145074G14	1	1 single layer, cw	24R2	15		1.1 μh nom at 13 mc; slug tuning; min Q80; impregnate method 1.
L115	C2145074G15	1	1 single layer, cw	24R2	14		0.98 μh nom at 14 mc; slug tuning; min Q80; impregnate method 1.
L116 L117	C2145074G16	1	1 single layer, cw	23R2	13		0.86 μh nom at 15 mc; slug tuning; min Q80; impregnate method 1.

TABLE 7-10. WINDING DATA (cont)

DESIG-NATION SYMBOL	PART NUMBER	DIAGRAM	WINDING	WIRE SIZE	TURNS	D-C RESIST-ANCE (Ohms)	REMARKS
L118	C2145074G18	1	1 single layer, cw	22R2	11		0.66 μh nom at 17 mc; slug tuning; min Q80; impregnate method 1.
L119	C2145074G19	1	1 single layer, cw	22R2	11		0.61 μh nom at 18 mc; slug tuning; min Q80; impregnate method 1.
L120	C2145074G20	1	1 single layer, cw	22R2	10		0.55 μh nom at 19 mc; slug tuning; min Q80; impregnate method 1.
L121	C2145116G1	1	1 single layer, cw	30R2	50		13.1 μh nom at 2 mc; slug tuning; Q40; impregnate method 1.
L122	C2145116G2	1	1 single layer, cw	26R2	32		6.2 μh nom at 3 mc; slug tuning; min Q60; impregnate method 1.
L123	C2145116G3	1	1 single layer, cw	24R2	24		3.7 μh nom at 4 mc; slug tuning; min Q70; impregnate method 1.
L124	C2145116G4	1	1 single layer, cw	23R2	22		3.0 μh nom at 5 mc; slug tuning; min Q70; impregnate method 1.
L125	C2145116G5	1	1 single layer, cw	22R2	20		2.5 μh nom at 6 mc; slug tuning; min Q70; impregnate method 1.
L126	C2145116G6	1	1 single layer, cw	22R2	18		2.1 μh nom at 7 mc; slug tuning; min Q70; impregnate method 1.
L127	C2145116G7	1	1 single layer, cw	21R2	17		1.9 μh nom at 8 mc; slug tuning; min Q70; impregnate method 1.
L128 L1010	C2145116G8	1	1 single layer, cw	20R2	15		1.7 μh nom at 9 mc; slug tuning; min Q70; impregnate method 1.
L401	B2145835G1	2	2 single layer, cw, shielded	27R2	33 30		47 μh ±1% at 2.5 mc; slug tuning; min Q90; impregnate method 1.
L402 L403	D2145072G18	3	1 pie universal	38EF2	16	0.712	1.82–2.70 μh at 7.9 mc w/slug; min Q35; impregnate method 1.
L404	D2145072G17	5	1 single layer, cw	32EF2	18	0.193	1.35–1.80 μh at 7.9 mc w/slug; min Q60; impregnate method 1.

TABLE 7–10. WINDING DATA (cont)

DESIGNATION SYMBOL	PART NUMBER	DIAGRAM	WINDING	WIRE SIZE	TURNS	D-C RESISTANCE (Ohms)	REMARKS
L405	D2145072G16	5	1 single layer, cw	32EF2	17	0.185	1.26–1.75 μh at 7.9 mc w/slug; min Q55; impregnate method 1.
L406	D2145072G14	5	1 single layer, cw	32EF2	15	0.160	1.00–1.50 μh at 7.9 mc w/slug; min Q55; impregnate method 1.
L407	D2145072G13	5	1 single layer, cw	28EF2	14	0.061	0.87–1.10 μh at 25 mc w/slug; min Q85; impregnate method 1.
L408 L427	D2145072G12	5	1 single layer, cw	28EF2	11	0.052	0.63–0.89 μh at 25 mc w/slug; min Q75; impregnate method 1.
L409 L411 L420	D2145072G10	4	1 single layer, cw	28EF2	9	0.039	0.44–0.59 μh at 25 mc w/slug; min Q80; impregnate method 1.
L410 L416	D2145072G7	4	1 single layer, cw	28EF2	6	0.027	0.25–0.32 μh at 25 mc w/slug; min Q70; impregnate method 1.
L412	D2145072G1	4	1 single layer, cw	22EF2	2	0.005	0.045–0.065 μh at 25 mc w/slug; min Q60; impregnate method 1.
L413	D2145072G3	4	1 single layer, cw	22EF2	4	0.006	0.13–0.15 μh at 25 mc w/slug; min Q55; impregnate method 1.
L414	D2145072G4	4	1 single layer, cw	22EF2	5	0.008	0.17–0.19 mc μh at 25 mc w/slug; min Q65; impregnate method 1.
L415	D2145072G5	4	1 single layer, cw	22EF2	6	0.008	0.21–0.27 μh at 25 mc w/slug; min Q70; impregnate method 1.
L417	D2145072G8	4	1 single layer, cw	28EF2	7	0.031	0.31–0.38 μh at 25 mc w/slug; min Q65; impregnate method 1.
L418 L419 L433	D2145072G9	4	1 single layer, cw	28EF2	8	0.036	0.36–0.44 μh at 25 mc w/slug; min Q75; impregnate method 1.
L421 L423 L424 L432	A2145050	7	2 pie universal	36ESN		3.5	50 μh ±10% at 2.5 mc; 75 ma dc rated current; min Q25; hipot ac volts 1000 v rms.

TABLE 7–10. WINDING DATA (cont)

DESIGNATION SYMBOL	PART NUMBER	DIAGRAM	WINDING	WIRE SIZE	TURNS	D-C RESISTANCE (Ohms)	REMARKS
L425 L426 L428 thru L431	D2145072G11	4	1 single layer, cw	28EF2	10	0.044	0.53–0.70 μh at 25 mc w/slug; min Q80; impregnate method 1.
L434 L708	D2145073G2	6	1 pie universal	38EF2	22	1.0	3.23–5.8 μh at 7.9 mc w/slug; min Q51; impregnate method 1.
T401	A2145031	8	Primary (3–4), secondary (1–2)	26DSC 26DSC	9 9		Primary and secondary at mid-range, 1 μh at mc; min Q100; 250 wvdc, 10 ma.
L701	D2145073G8	6	1 pie universal	7/41	133	2.41	120–180 μh at 0.79 mc w/slug; min Q45; impregnate method 1.
L702 L704 L706 L711	D2145073G4	6	1 pie universal	5/41	68	1.68	32–53 μh at 2.5 mc w/slug; min Q40; impregnate method 1.
L703 L710	D2145073G5	6	1 pie universal	5/41	80	2.06	47–76 μh at 2.5 mc w/slug; min Q45; impregnate method 1.
L705 L707	D2145073G1	9	1 single layer, cw	32EF2	15	low	1.47–2.47 μh at 7.9 mc w/slug; min Q50; impregnate method 1.
L709	D2145073G3	6	1 pie universal	5/41	54	1.27	20–28 μh at 2.5 mc w/slug; min Q50; impregnate method 1.
L712	D2145073G7	6	1 pie universal	7/41	147	2.97	170–245 μh at 0.79 mc w/slug; min Q53; impregnate method 1.
T701 T702	A2145032	8	Primary (3–4), secondary (1–2)	7/41 7/41			Primary and secondary: 100 μh at 790 kc; min Q45; adjustable; 250 wvdc, 10 ma.
T703	B2145407	10	Primary (1–2), secondary (3–4–5) ct (4)	26 26	20 36 ct		
L1001 L1004 L1005	C2144258–2	—	1 winding, silver ribbon conductor	46.5 ft. lg, 0.062 in. wd, 0.015 in. thk	variable		0.43–18 μh variable tuning. See paragraph 7–4*b*(2) for winding data.

TABLE 7–10. WINDING DATA (cont)

DESIGNATION SYMBOL	PART NUMBER	DIAGRAM	WINDING	WIRE SIZE	TURNS	D-C RESISTANCE (Ohms)	REMARKS
L1003	A2133325G3	11	4 pie universal			38	2.5 mh ±10% at 2.7 mc; 125 ma dc rated current; Q47 at 250 kc.
L1011	A2147684	12	Single, right hand, equally spaced	FTR 910000H10 copper, annealed, tinned	3		
L1012	A2147685	13	Single, right hand, equally spaced	FTR 910000H10	3		
T1001 T1202	B2144295–2 B2144295–1	14	1–2 wound on toroidal core of Allegheny Mu-metal; 3–4 grounding strap; turns insulated with electrical tape.	(1–2) copper strip 13 in. lg, 1/8 in. wd, 0.002 in. thk; (3–4) copper strip 0.010 in. thk, 5/16 in. wd,	5		Impedance (min): 180 + j 132 ± 20% at 3 mc 225 + j 136 ± 20% at 5 mc 300 + j 100 ± 20% at 10 mc
Z1002	B2146358	15	Single, left hand, equally spaced, wound on 47-ohm, 2-watt resistor	16	3		
L1201	C2144258–1	—	1 winding, silver ribbon conductor	36.5 ft lg, 0.062 in. wd, 0.015 in. thk	variable		0.5–50 μh variable tuning. See paragraph 7–4*b*(4) for winding data.
T1201	C2144901	16	Single on toroidal core of Allegheny Mu-metal; turns insulated with electrical tape	0.10 in. thk copper strip silver pl, 16-7/16 in. lg, tapered from 3/8 in. to 1/8 in.	tapped at 8-1/8 in.		2 to 30 mc frequency range; input impedance 50 ohms when terminated in 15 ohms; 150 watts.
T1401	A2145142	10	Primary (1–2), secondary (3–4–5) ct (4)				Primary: 115 vac, 60 cps ±10%. Secondary; 28–0–28 vdc at 60 amp. Hipot ac volts 500 vdc.
L1512 L1513	B2148347	1	1 winding 3 layers, closewound, cw	20	60		27 μh at 1 kc; slug tuning; impregnate method 1.

TABLE 7-10. WINDING DATA (cont)

DESIG-NATION SYMBOL	PART NUMBER	DIAGRAM	WINDING	WIRE SIZE	TURNS	D-C RESIST-ANCE (Ohms)	REMARKS
T1501	D2145396G1	18	Primary (1-2), single layer, close-wound, cw; secondary (1-3), 1 pie universal	32DSC 5-41 Litz	5 45, tapped at 12		Secondary: 31 μh at 2 mc; inductance start to tap 3.05 μh; impregnate method 1.
T1502	D2145396G2	24	1 single layer, close-wound, cw	28R2	37; tap 1 at 2-1/2; tap 2 at 6		8.6 μh at 7.9 mc; slug tuning; Q93; impregnate method 1.
T1503	D2145396G3	24	1 single layer, close-wound, cw	22R2	18; tap 1 at 1-1/2		2.3 μh at 7.9 mc; slug tuning; Q90; impregnate method 1.
T1504	D2145396G4	22	1 single layer, spaced, cw	18R2	8; tap 1 at 1/4; tap 2 at 2		0.5 μh at 25 mc; slug tuning; Q125; impregnate method 1.
T1505	D2145396G5	17	2 pie universal primary (2-4), secondary (1-3)	5-41 Litz 5-41 Litz	230 43		Primary: 740 μh at 0.78 mc; nom Q55. Secondary: 35.5 μh at 2.5 mc; nom Q40; slug tuning; M:1080 aid, 800 oppose; impregnate method 1.
T1506	D2145396G6	18	Primary (2-4), 1 pie universal; secondary (1-3), single layer, close-wound, cw	5-41 Litz 32DSC	105 30		Primary: 158 μh at 790 mc; nom Q40. Secondary: 9 μh at 7.9 mc; nom Q60; slug tuning; M:222 aid, 122 oppose; impregnate method 1.
T1507	D2145396G7	19	Primary (2-4), 1 pie universal; secondary (1-3), single layer, close-wound, cw	36DSC 24R2	60 16		Primary: 48 μh at 2.5 mc; nom Q18. Secondary: 2.4 μh at 7.9 mc; nom Q32; slug tuning M:86 aid, 57 oppose; impregnate method 1.
T1508	D2145396G8	22	1 single layer, spaced, cw	20R2	7, untapped		0.41 μh at 25 mc; slug tuning; Q150; impregnate method 1.
T1509	D2145396G9	17	2 pie universal; primary (2-4); secondary (1-3)	5-41 Litz 5-41 Litz	64 45		Primary: 49 μh at 2.5 mc; nom Q50. Secondary: 31 μh at 2.5 mc; nom Q60; slug tuning; M:104 aid, 69 oppose; impregnate method 1.

TABLE 7–10. WINDING DATA (cont)

DESIGNATION SYMBOL	PART NUMBER	DIAGRAM	WINDING	WIRE SIZE	TURNS	D-C RESISTANCE (Ohms)	REMARKS
T1510	D2145396G10	21	Primary (2–4), 1 pie universal; secondary (1–3), single layer, closewound, cw	5–41 Litz 32DSC	21-1/2 30		Primary: 9 μh at 7.9 mc; nom Q35. Secondary: 7 μh at 7.9 mc; nom Q40; slug tuning; M:29.2 aid, 11.1 oppose; impregnate method 1.
T1511	D2145396G11	21	Primary (2–4), 1 pie universal; secondary (1–3), single layer, closewound, cw	36DSC 24R2	11 16		Primary: 2.43 μh at 7.9 mc; nom Q22. Secondary: 1.83 μh at 7.9 mc; nom Q40; slug tuning; M:81 aid, 2.9 oppose; impregnate method 1.
T1512	D2145396G12	23	1 single layer, spaced, cw	20R2	7, untapped		0.41 μh at 25 mc; slug tuning; Q150; impregnate method 1.
T1513	C2147014G1	27	Plate (1–3), grid (2–4), 2 single layer, closewound, cw	30R2 30R2	69 26-1/2		Plate: 27 μh at 2.5 mc, Q100. Grid: 9.1 μh at 7.9 mc, Q100; slug tuning; impregnate method 2.
T1514	D2145396G13	25	1 pie universal	5–41 Litz	40		31 μh at 25 mc; slug tuning; Q80; impregnate method 1.
T1515	D2145396G14	26	1 single layer, closewound, cw	36DSC	24		8.4 μh at 7.9 mc; slug tuning; Q90; impregnate method 1.
T1516 T1517	D2145396G15	26	1 single layer, closewound, cw	24R2	13		1.8 μh at 7.9 mc; slug tuning; Q75; impregnate method 1.
T1519	C2144856–3	29	Primary (1–2), single layer; secondary (3–4), 1 pie universal; shielded	10–44 Litz 10–44 Litz	35 85		Primary: 11.5 μh at 2.5 mc; min Q90. Secondary: 100 μh at 2.5 mc; min Q70; double-tuned.
T1520	C2144856–2	30	2 pie universal, primary (1–2), secondary (3–4)	10–44 Litz 10–44 Litz	85 85		Primary and secondary: 102 μh at 790 kc; min Q75; double-tuned.
T1523	C2147014G2	28	Plate (1–3); grid (2–4); 2 single layer, closewound, cw	24R2 32DSC	13 5-1/2		Plate: 1.74 μh at 7.9 mc; Q100. Grid: 0.68 μh at 25 mc; Q100; slug tuning; impregnate method 2.

TABLE 7-10. WINDING DATA (cont)

DESIG-NATION SYMBOL	PART NUMBER	DIAGRAM	WINDING	WIRE SIZE	TURNS	D-C RESIST-ANCE (Ohms)	REMARKS
L1602	C2144856-4	31	1 pie universal	10-44 Litz	150, tapped at 84 turns		Terminals (1 to 3): 250 μh at 790 kc; min Q70; terminals (2 to 3); 50 μh at 790 kc; slug tuning.
T1601 T1602 T1603 T1604 T1605	C2144856-1	32	4 windings; L1 (pie universal) L2 (pie universal) L3 (single layer) L4 (single layer)	All 10-41 Litz S.S.	L1-90 L2-90 L3-3 L4-1		L1: 123 μh at 790 kc; min Q70. L2: 126 μh at 790 kc; min Q70; double-tuned.
T1701 T1702 T1751 T1752	C2144856-5	33	2 pie universal primary (1-2), secondary (3-4)	10-44 Litz 10-44 Litz	220 220		Primary: 740 μh at 790 kc; min Q95. Secondary: 780 μh at 790 kc; min Q84; double-tuned.
T1753	A2147158	34	2 windings; primary (D-F) secondary (A-C)				Primary: 980 μh at 455 kc; min Q94. Secondary: 820 μh at 455 kc; min Q86.

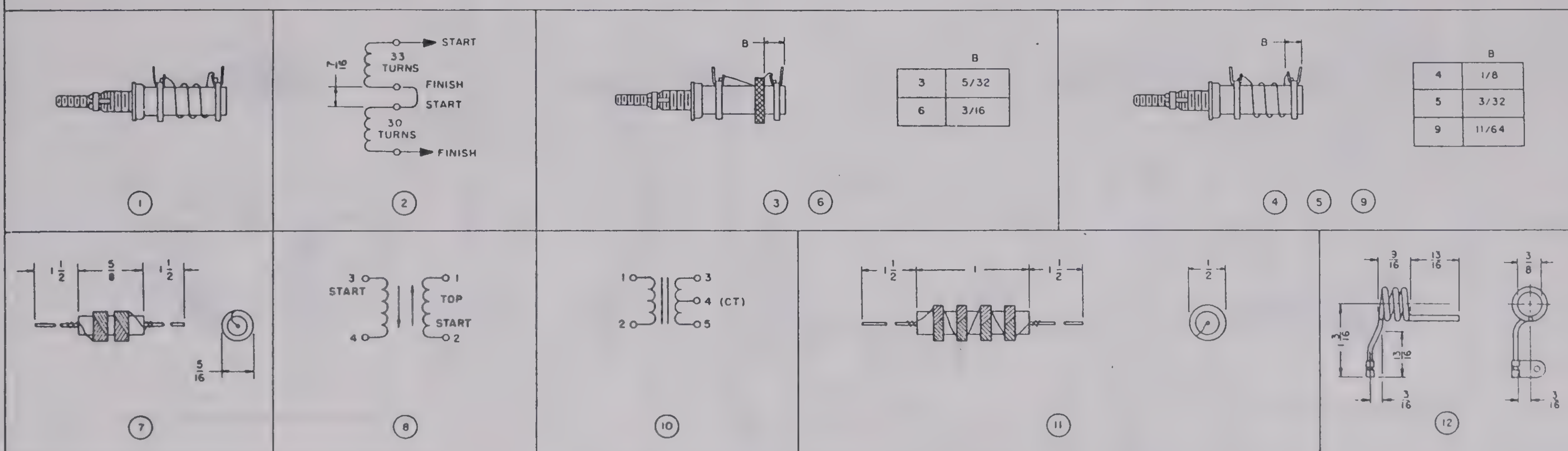
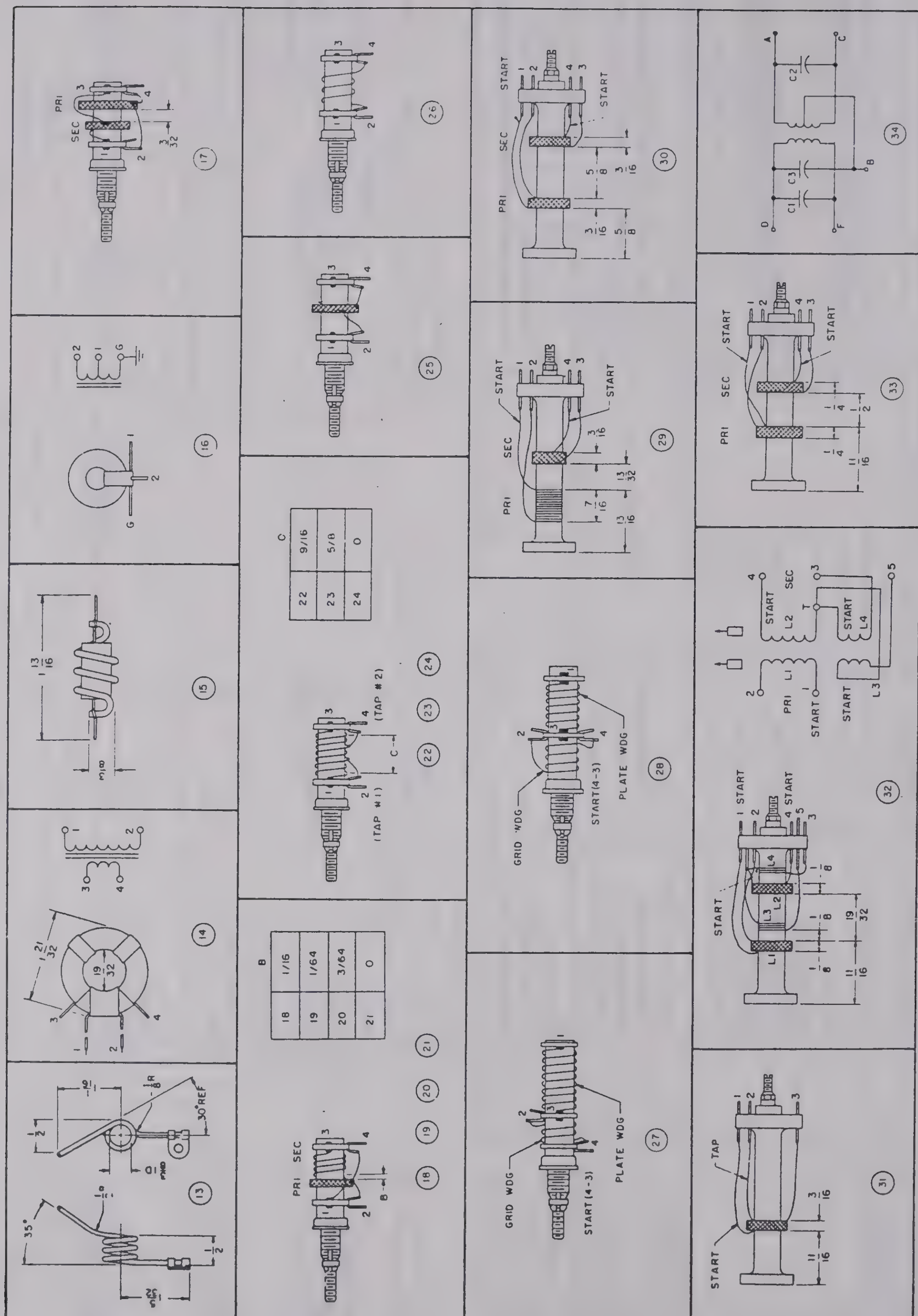


TABLE 7-10. WINDING DATA (cont)



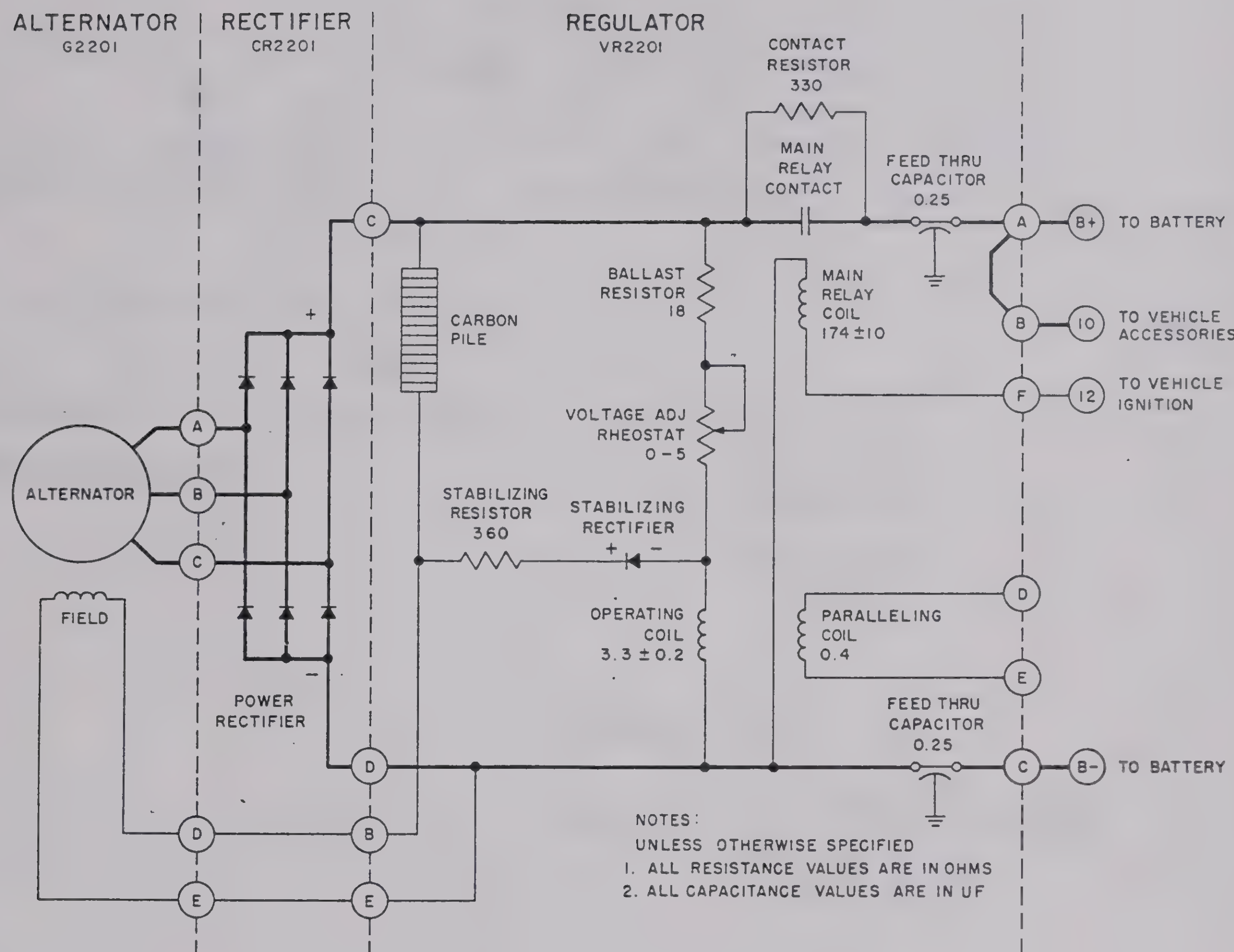


Figure 7-94. Generator System, Schematic Diagram

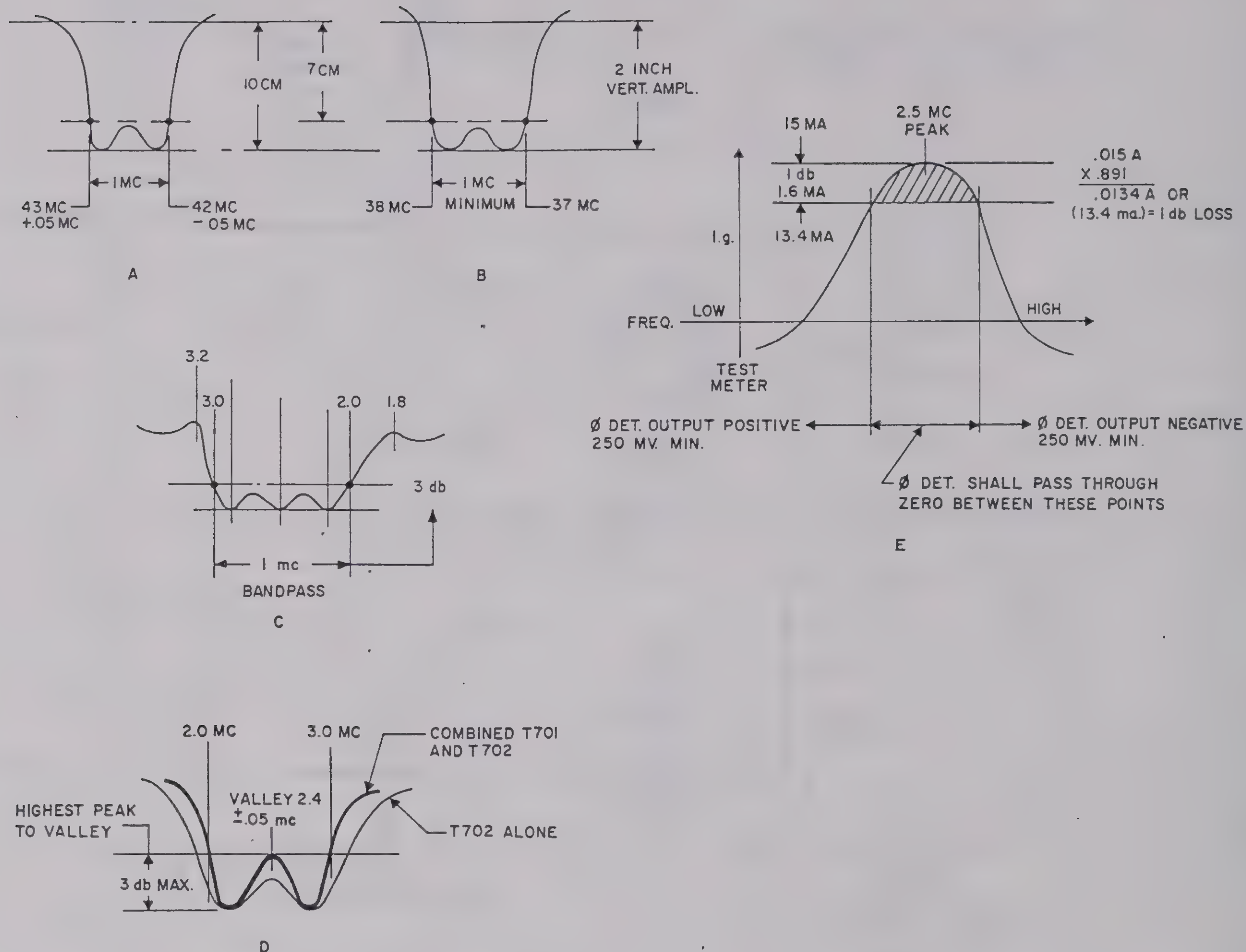


Figure 7–95. AN/MRC–55 Alignment Waveforms

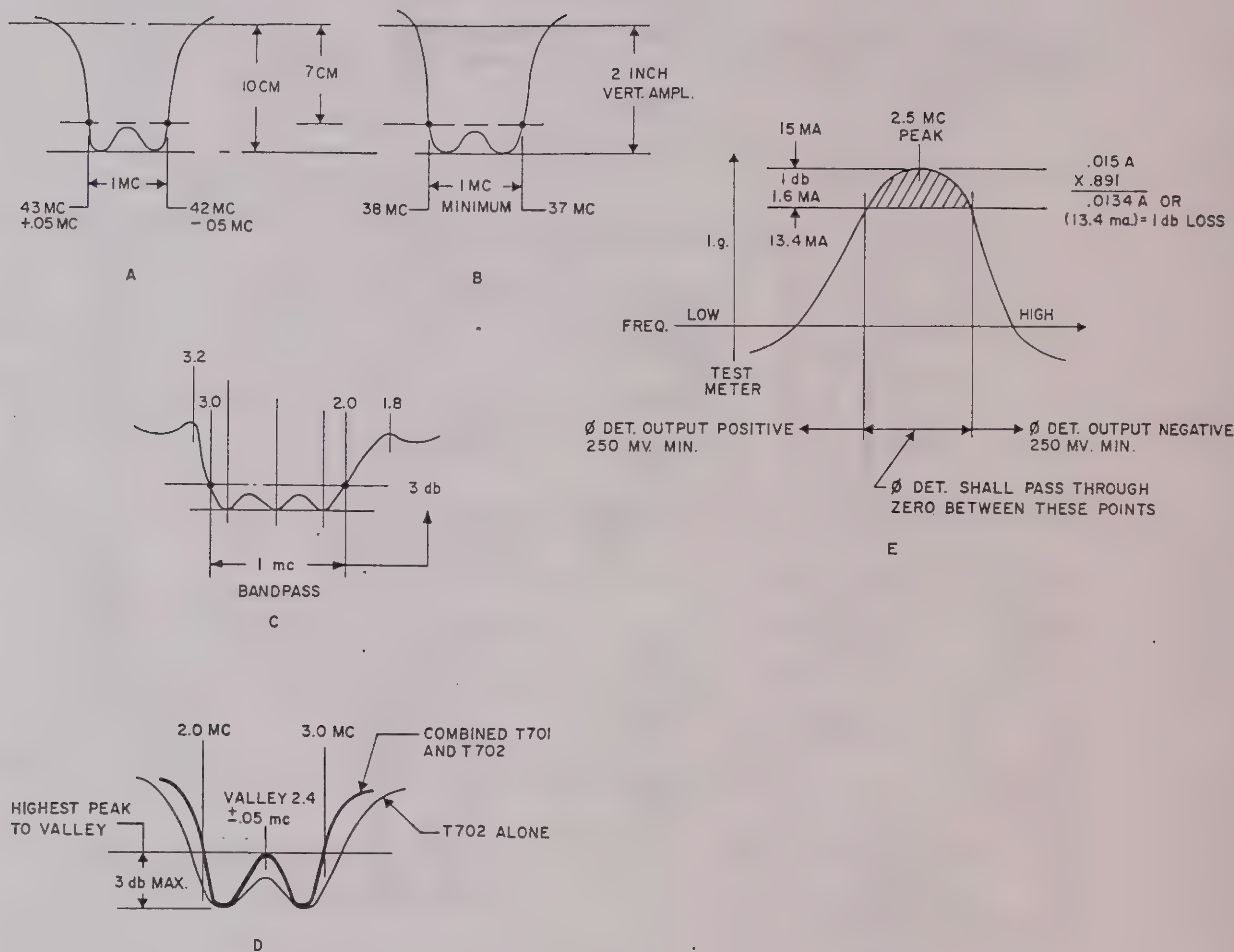
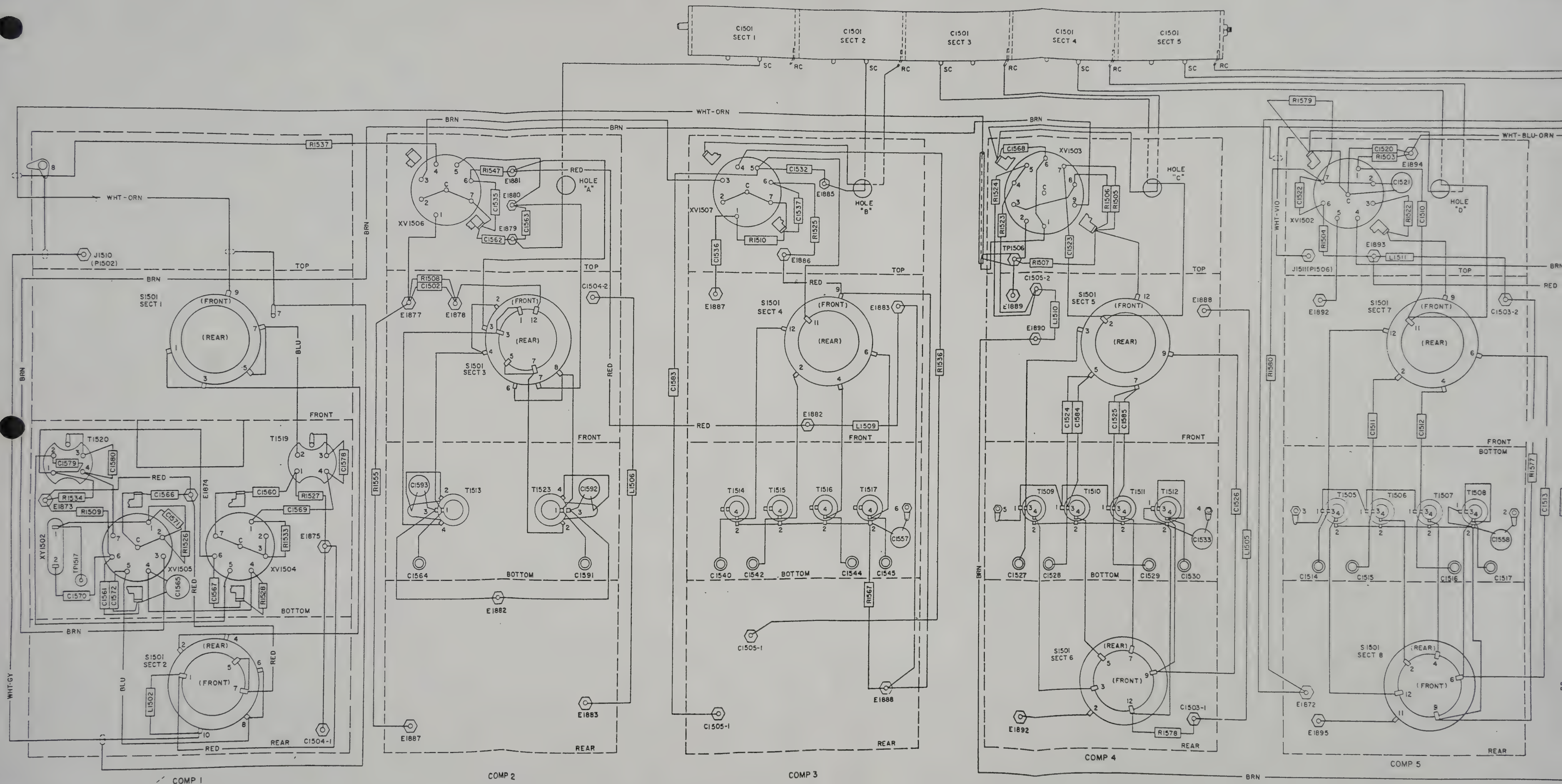
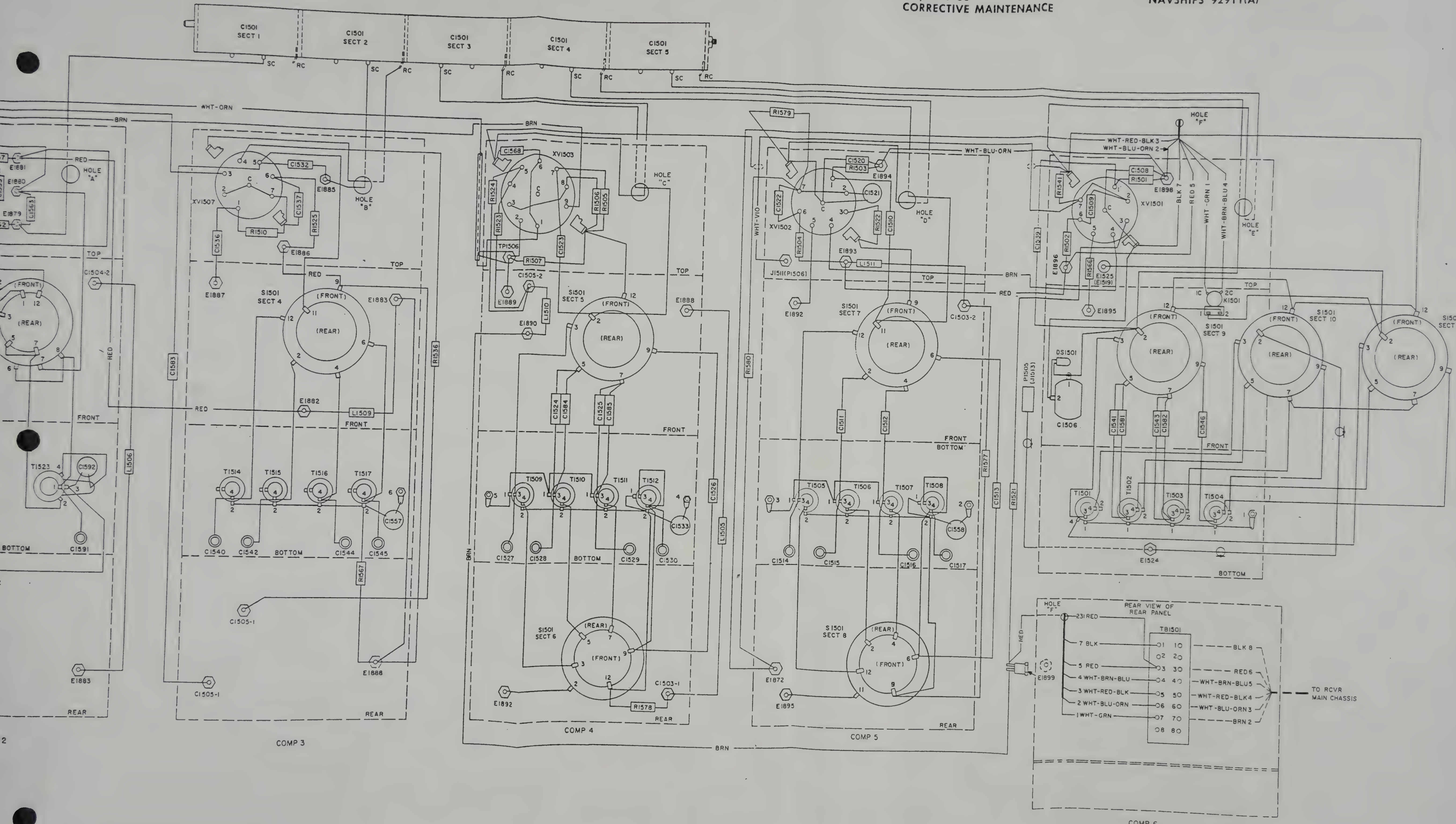
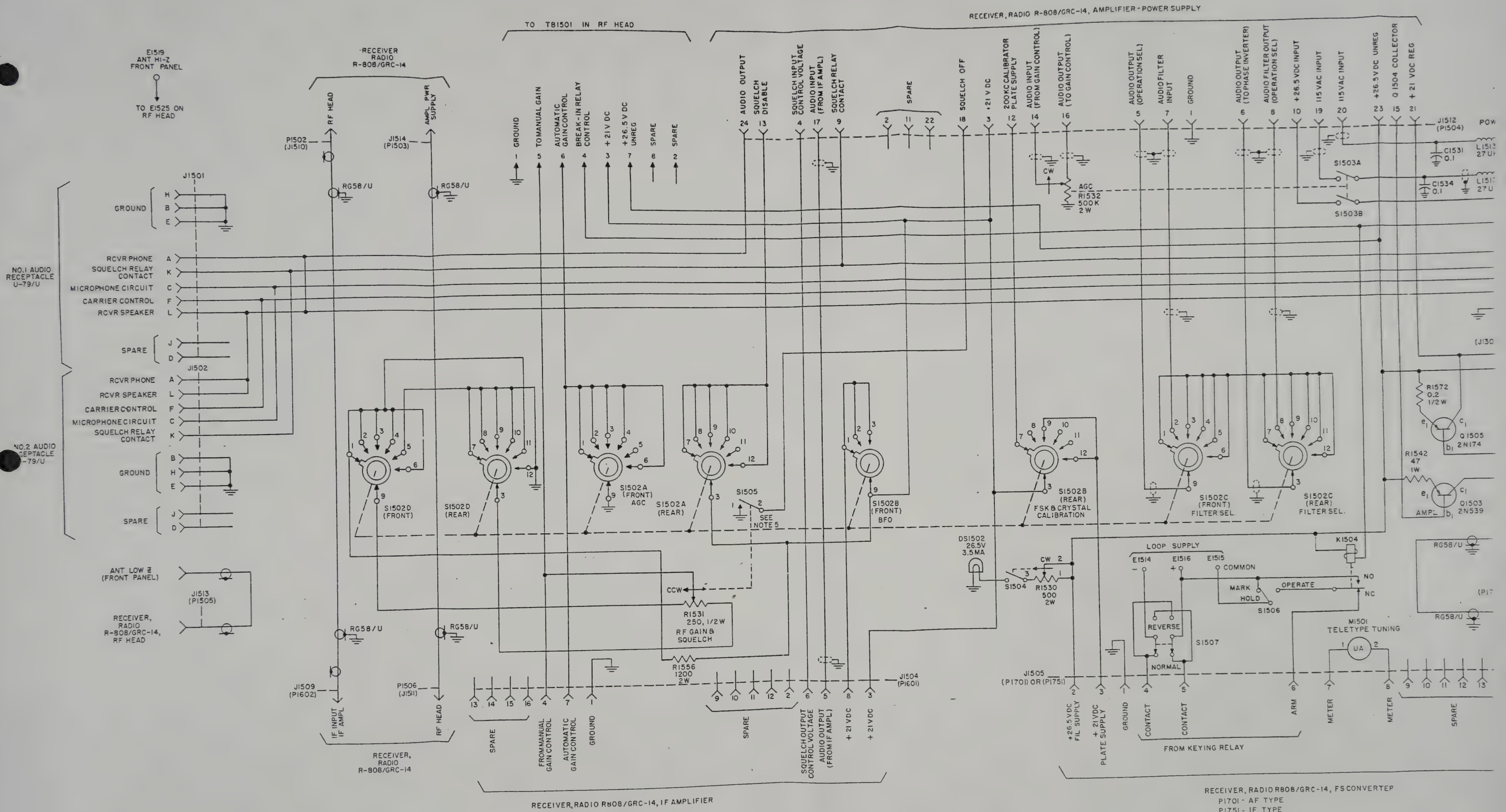


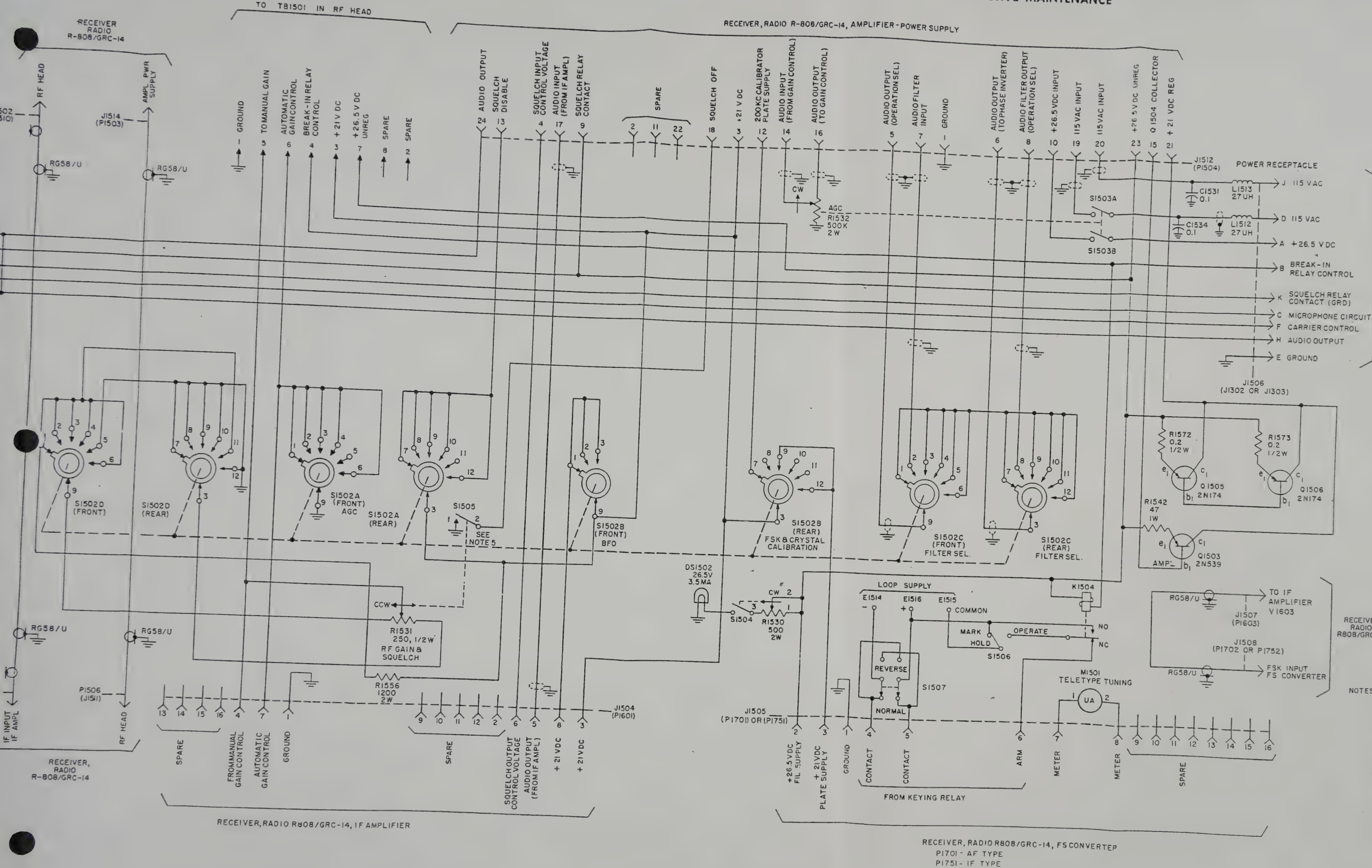
Figure 7–95. AN/MRC–55 Alignment Waveforms


C1501 SECT 1
C1501 SECT 2
C1501 SECT 3
C1501 SECT 4
C1501 SECT 5
COMP 1
COMP 2
COMP 3
COMP 4
COMP 5
S1501 SECT 1
S1501 SECT 2
S1501 SECT 3
S1501 SECT 4
S1501 SECT 5
S1501 SECT 6
S1501 SECT 7
S1501 SECT 8
XV1506
XV1507
XV1503
XV1502
XV1505
XV1504
HOLE "A"
HOLE "B"
HOLE "C"
HOLE "D"
J1510 (P1502)
J1511 (P1506)
WHT-ORN
WHT-BLU-ORN
BRN
RED
BLU
WHT-GY
WHT-VIO
TOP
FRONT
BOTTOM
REAR


C1501 SECT 1
C1501 SECT 2
C1501 SECT 3
C1501 SECT 4
C1501 SECT 5
S1501 SECT 4
S1501 SECT 5
S1501 SECT 6
S1501 SECT 7
S1501 SECT 8
S1501 SECT 9
S1501 SECT 10
S1501 SECT 11
REAR VIEW OF REAR PANEL
TB1501
TO RCVR MAIN CHASSIS
COMP 3
COMP 4
COMP 5
COMP 6



RECEIVER, RADIO R-808/GRC-14, AMPLIFIER-POWER SUPPLY
TO TB1501 IN RF HEAD
E1519 ANT HI-Z FRONT PANEL
TO E1525 ON RF HEAD
RECEIVER RADIO R-808/GRC-14
RF HEAD
AMPL PWR SUPPLY
P1502 (J1510)
J1514 (P1503)
RG58/U
J1501
GROUND
RCVR PHONE
SQUELCH RELAY CONTACT
MICROPHONE CIRCUIT
CARRIER CONTROL
RCVR SPEAKER
SPARE
NO.1 AUDIO RECEPTACLE U-79/U
J1502
NO.2 AUDIO RECEPTACLE U-79/U
ANT LOW Z (FRONT PANEL)
J1513 (P1505)
RECEIVER, RADIO R-808/GRC-14, RF HEAD
GROUND
TOMANUAL GAIN
AUTOMATIC GAIN CONTROL
BREAK-IN RELAY CONTROL
+21 V DC
+26.5 V DC UNREG
AUDIO OUTPUT
SQUELCH DISABLE
SQUELCH INPUT CONTROL VOLTAGE
AUDIO INPUT (FROM IF AMPL)
SQUELCH RELAY CONTACT
SQUELCH OFF
200KC CALIBRATOR PLATE SUPPLY
AUDIO INPUT (FROM GAIN CONTROL)
AUDIO OUTPUT (TO GAIN CONTROL)
AUDIO OUTPUT (OPERATION SEL)
AUDIO FILTER INPUT
AUDIO OUTPUT (TO PHASE INVERTER)
AUDIO FILTER OUTPUT (OPERATION SEL)
+26.5 VDC INPUT
115 VAC INPUT
+26.5 V DC UNREG
Q 1504 COLLECTOR
+21 VDC REG
J1512 (P1504)
C1531 0.1
C1534 0.1
L1513 27 UH
S1503A
S1503B
CW
AGC R1532 500K 2W
S1502D (FRONT)
S1502D (REAR)
S1502A (FRONT) AGC
S1502A (REAR)
S1505
SEE NOTE 5
S1502B (FRONT) BFO
S1502B (REAR) FSK & CRYSTAL CALIBRATION
S1502C (FRONT) FILTER SEL.
S1502C (REAR) FILTER SEL.
R1572 0.2 1/2W
Q1505 2N174
R1542 47 1W
Q1503 2N539
AMPL
CCW
R1531 250, 1/2W RF GAIN & SQUELCH
R1556 1200 2W
DS1502 26.5V 3.5MA
S1504
R1530 500 2W
LOOP SUPPLY
E1514
E1516
E1515
COMMON
MARK
HOLD
OPERATE
S1506
K1504
NO
NC
REVERSE
NORMAL
S1507
M1501 TELETYPE TUNING
UA
J1509 (P1602)
P1506 (J1511)
IF INPUT IF AMPL
RECEIVER, RADIO R-808/GRC-14
SPARE
FROMMANUAL GAIN CONTROL
AUTOMATIC GAIN CONTROL
SQUELCH OUTPUT CONTROL VOLTAGE
AUDIO OUTPUT (FROM IF AMPL)
+21 VDC
J1504 (P1601)
J1505 (P1701) OR (P1751)
+26.5 VDC FIL SUPPLY
+21 VDC PLATE SUPPLY
CONTACT
FROM KEYING RELAY
ARM
METER
RECEIVER, RADIO R808/GRC-14, IF AMPLIFIER
RECEIVER, RADIO R808/GRC-14, FS CONVERTER
P1701 - AF TYPE
P1751 - IF TYPE

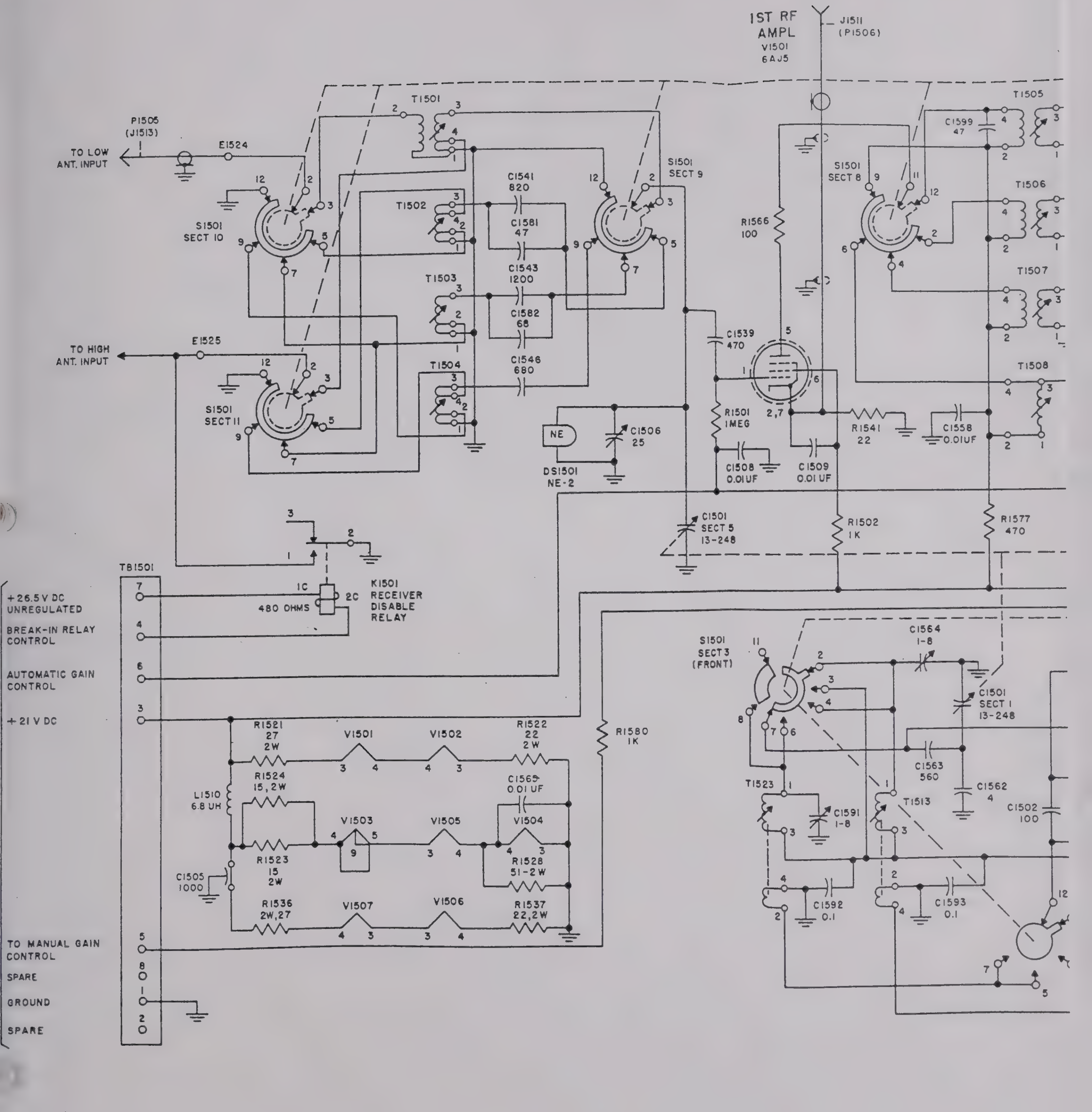


S 1502 POSITIONS	
1,7	CAL
2,8	CW SHARP
3,9	CW, FSK BROAD
4,10	MCW PHONE
5,11	BROAD PHONE
6,12	FSK, PHONE

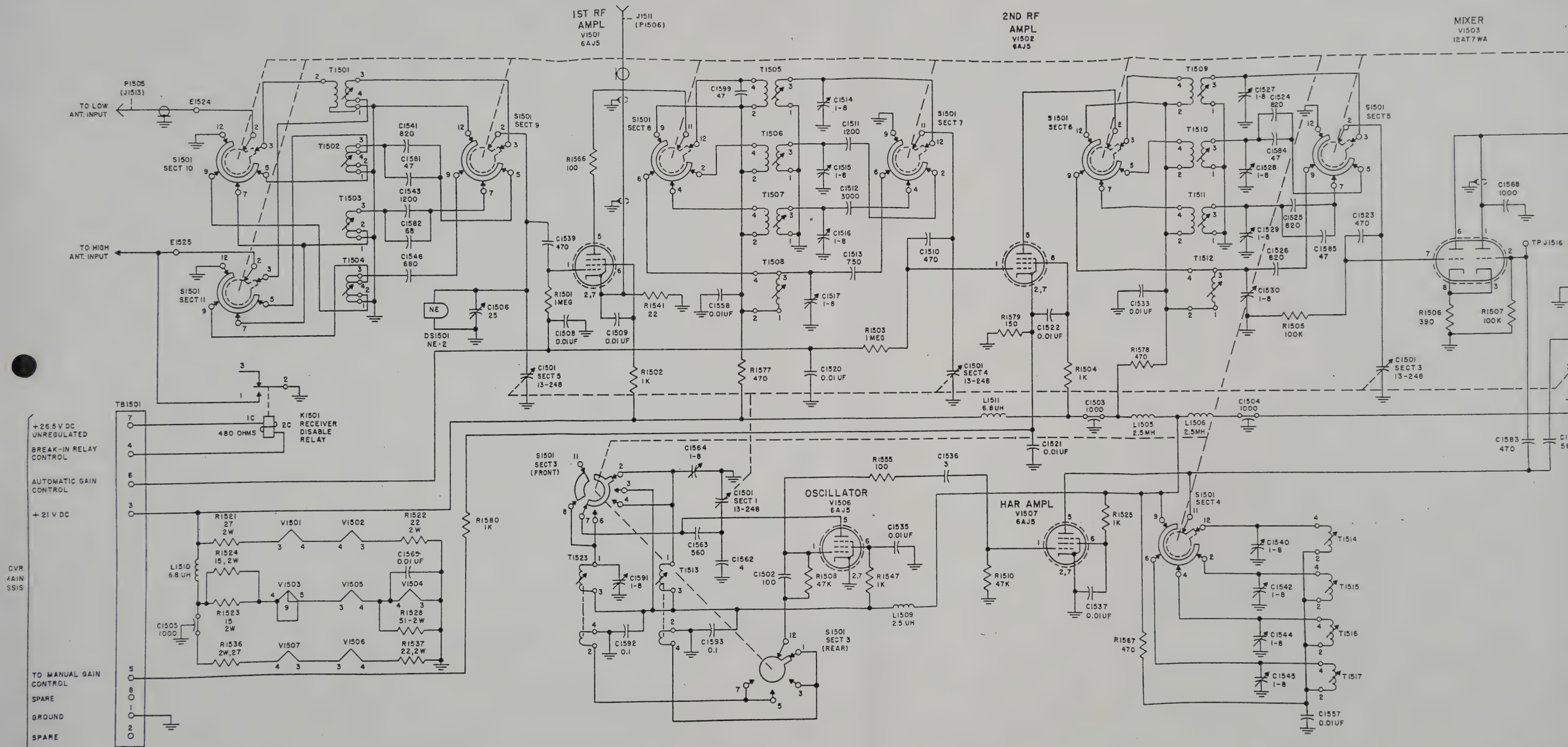
NOTES

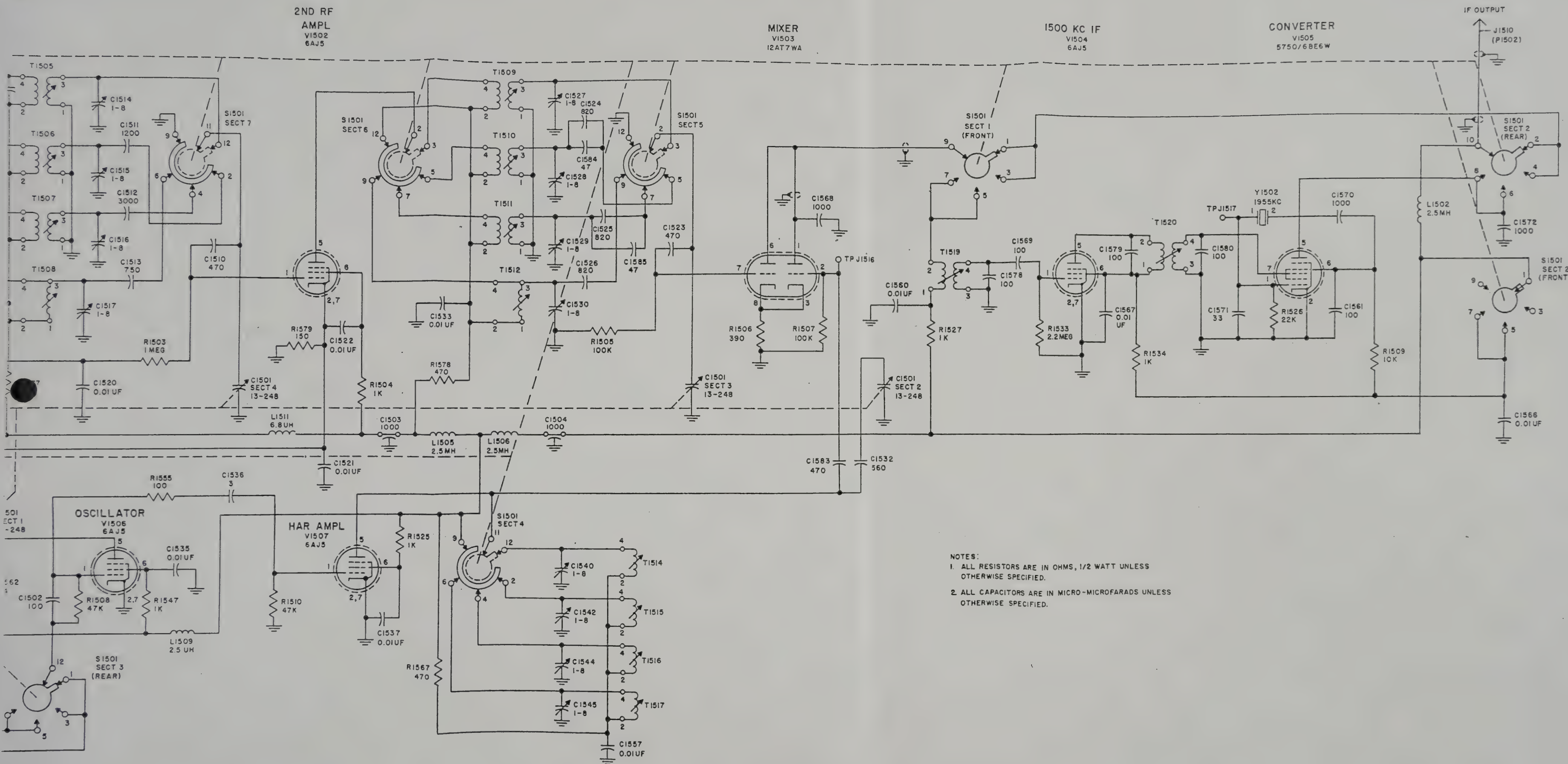
1. ALL RESISTORS ARE IN OHMS, 1/2 WATT UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS ARE IN MICRO MICROFARADS UNLESS OTHERWISE SPECIFIED.
3. REMOTE LOOP SUPPLY TELETYPE LINE CONNECTED TO E1516.
4. LOCAL LOOP SUPPLY-CONNECT E1516 OR E1514 TO TT LOOP SUPPLY + (PLUS) CONNECT E1515 AND TT LOOP SUPPLY-(MINUS) TO TTY LINE.
5. SQUELCH IN OFF POSITION WHEN S1505 IS OPEN. (R1531) EXTREME COUNTERCLOCKWISE POSITION)

Figure 7-78. Receiver Main Chassis, Schematic D



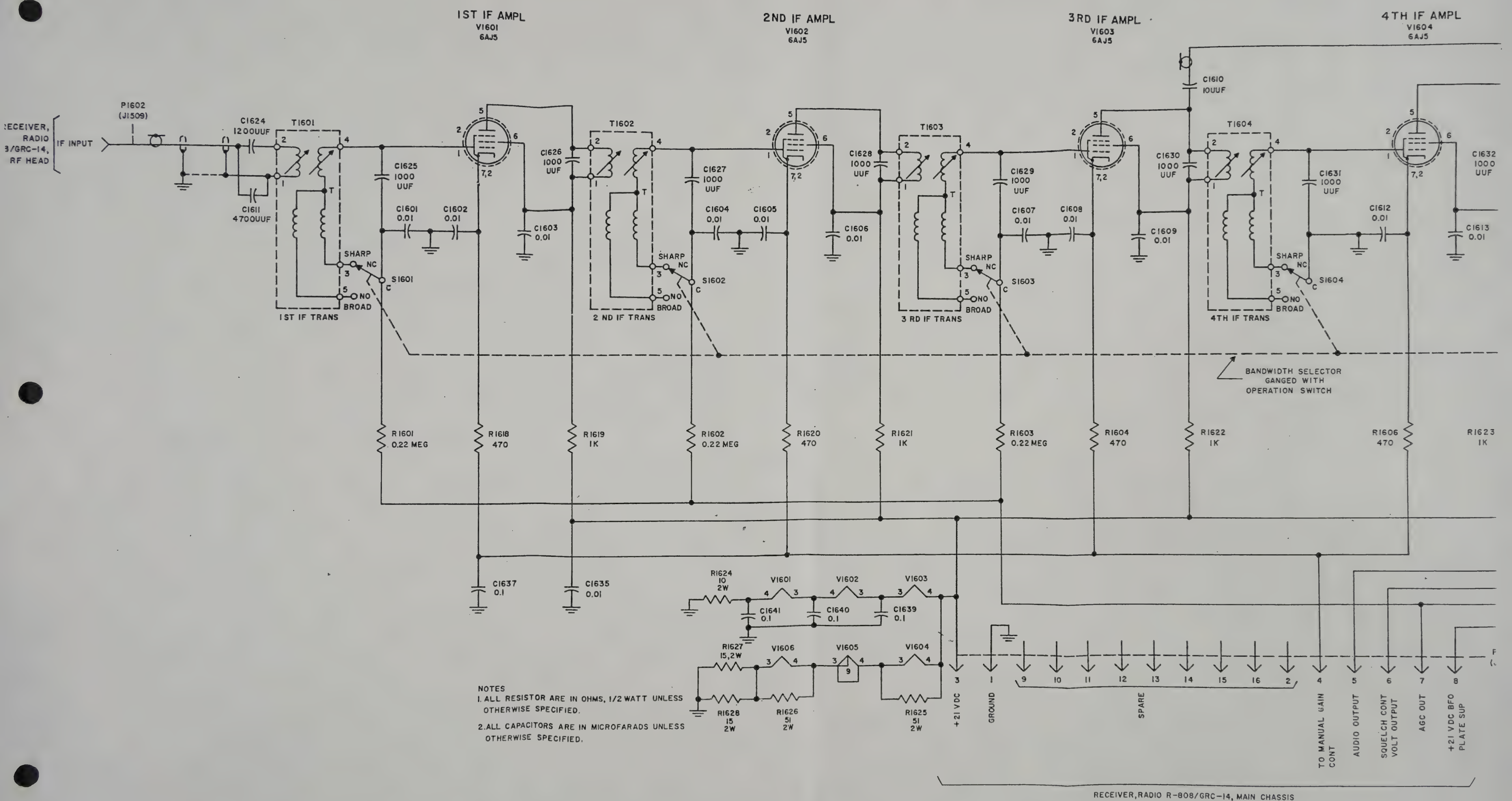
1ST RF AMPL
V1501
6AJ5
J1511
(P1506)
T1501
T1505
P1505
(J1513)
TO LOW ANT. INPUT
E1524
S1501 SECT 10
T1502
C1541 820
C1581 47
C1543 1200
S1501 SECT 9
C1599 47
S1501 SECT 8
R1566 100
T1506
T1507
T1503
C1582 68
TO HIGH ANT. INPUT
E1525
S1501 SECT 11
T1504
C1546 680
C1539 470
R1501 1MEG
R1541 22
C1558 0.01UF
T1508
NE
C1506 25
DS1501 NE-2
C1508 0.01UF
C1509 0.01 UF
C1501 SECT 5 13-248
R1502 1K
R1577 470
TB1501
K1501 RECEIVER DISABLE RELAY
480 OHMS
+26.5 V DC UNREGULATED
BREAK-IN RELAY CONTROL
AUTOMATIC GAIN CONTROL
+21 V DC
S1501 SECT 3 (FRONT)
C1564 1-8
C1501 SECT 1 13-248
R1521 27 2W
V1501
V1502
R1522 22 2W
R1580 1K
C1563 560
C1562 4
L1510 6.8 UH
R1524 15, 2W
C1565 0.01 UF
T1523
C1591 1-8
T1513
C1502 100
V1503
V1505
V1504
R1523 15 2W
R1528 51-2W
C1505 1000
R1536 2W,27
V1507
V1506
R1537 22,2W
C1592 0.1
C1593 0.1
TO MANUAL GAIN CONTROL
SPARE
GROUND
SPARE


1ST RF AMPL
V1501
6AJ5
J1511
(P1506)
2ND RF AMPL
V1502
6AJ5
MIXER
V1503
12AT7WA
TO LOW ANT. INPUT
P1505
(J1513)
E1524
TO HIGH ANT. INPUT
E1525
T1501
T1502
T1503
T1504
S1501 SECT 10
S1501 SECT 11
S1501 SECT 9
C1541 820
C1581 47
C1543 1200
C1582 68
C1546 680
R1566 100
C1539 470
R1501 1MEG
C1506 25
NE
DS1501 NE-2
C1508 0.01UF
C1509 0.01 UF
R1541 22
S1501 SECT 8
C1599 47
T1505
T1506
T1507
T1508
C1514 1-8
C1515 1-8
C1516 1-8
C1511 1200
C1512 3000
C1513 750
C1558 0.01UF
C1517 1-8
S1501 SECT 7
C1510 470
R1503 1MEG
C1501 SECT 5 13-248
R1502 1K
R1577 470
C1520 0.01 UF
C1501 SECT 4 13-248
R1579 150
C1522 0.01 UF
R1504 1K
L1511 6.8UH
C1503 1000
C1521 0.01UF
S1501 SECT 6
T1509
T1510
T1511
T1512
C1527 1-8
C1524 820
C1584 47
C1528 1-8
C1525 820
C1529 1-8
C1526 820
C1585 47
C1530 1-8
C1533 0.01 UF
R1578 470
R1505 100K
L1505 2.5MH
L1506 2.5MH
C1504 1000
S1501 SECT 5
C1523 470
C1568 1000
TP J1516
R1506 390
R1507 100K
C1501 SECT 3 13-248
C1583 470
TB1501
+26.5 V DC UNREGULATED
BREAK-IN RELAY CONTROL
AUTOMATIC GAIN CONTROL
+21 V DC
TO MANUAL GAIN CONTROL
SPARE
GROUND
SPARE
K1501 RECEIVER DISABLE RELAY
480 OHMS
R1521 27 2W
R1522 22 2W
R1524 15, 2W
C1565 0.01 UF
L1510 6.8 UH
R1523 15 2W
R1528 51-2 W
C1505 1000
R1536 2W,27
R1537 22,2W
R1580 1K
S1501 SECT 3 (FRONT)
C1564 1-8
C1501 SECT 1 13-248
C1563 560
C1562 4
T1523
C1591 1-8
T1513
C1592 0.1
C1593 0.1
S1501 SECT 3 (REAR)
OSCILLATOR
V1506
6AJ5
R1555 100
C1536 3
C1535 0.01UF
C1502 100
R1508 47K
R1547 1K
L1509 2.5 UH
HAR AMPL
V1507
6AJ5
R1525 1K
R1510 47K
C1537 0.01UF
R1567 470
S1501 SECT 4
C1540 1-8
C1542 1-8
C1544 1-8
C1545 1-8
T1514
T1515
T1516
T1517
C1557 0.01UF



NOTES:
1. ALL RESISTORS ARE IN OHMS, 1/2 WATT UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS ARE IN MICRO-MICROFARADS UNLESS OTHERWISE SPECIFIED.

Figure 7-80. Radio Frequency Head, Schematic Diagram



NOTES
1. ALL RESISTOR ARE IN OHMS, 1/2 WATT UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

RECEIVER, RADIO R-808/GRC-14, MAIN CHASSIS

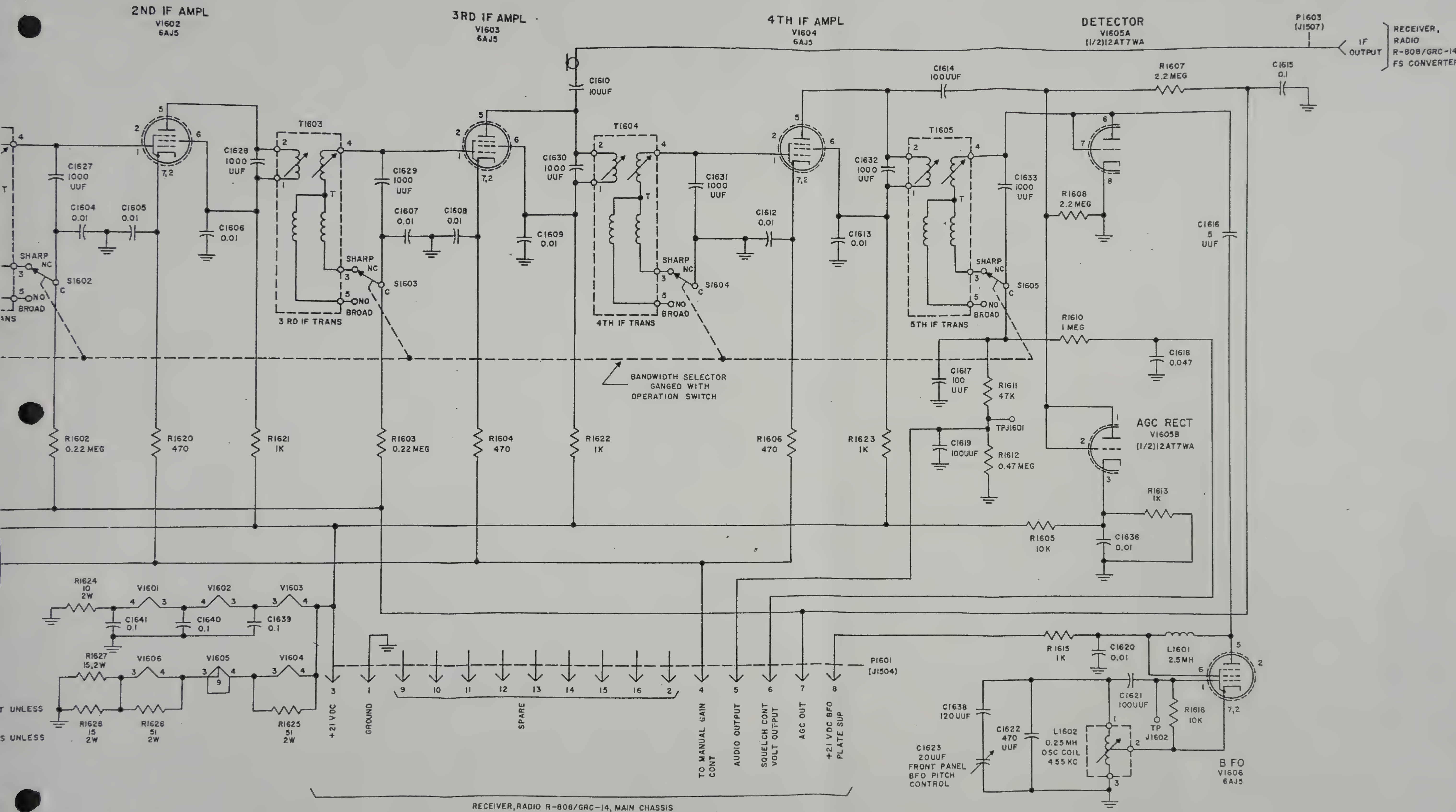


Figure 7-82. Intermediate Frequency Amplifier, Schematic Diagram

amplifier tube V902 will cause contacts 6 and 7 of K903 (load servo relay) to close. As a result, 26.5 volts from the control bus will be applied to the forward winding of B1202 through K903. The 26.5 volts is also applied to thermal relay K807 via K903, CR803, and K804. Diode CR802 or CR803 keeps voltage applied to K807 as long as either motor is tuning. The diodes also isolated the two motors from each other, thereby preventing either motor from being driven from the other's supply. The relay remains actuated until the rf tuner is resonated and properly matched to the antenna. Upon completion of the tuning, servo control relays K906 and K903 de-energize, removing power from the rf tuner motors and thermal relay K807.

Approximately four to ten seconds later, thermal relay K807 will cool and de-activate, causing its contacts (3, 4, and 8, 9) to return to their normally open positions. This will cause K804 to de-energize, the automatic control circuits will be disabled, and the transmitter will be ready for operation.

(1) FALSE SENSE RELAY K808.—The coil of relay K808 is connected in the grid circuit of power amplifier V1002. Current to energize the relay is only present when V1002 is near, or at, resonance because at other times V1002 will not be drawing grid current. When K808 is de-energized, −105 volts is applied to the tune servo amplifier (V903) input through normally closed contacts 3 and 4 of K808, and energized contacts 5 and 15 of K805. The −105 volts serves as a simulated control voltage to supply the necessary drive to V903 to energize B1002 and tune the rfa. When resonance is approached, V1002 draws grid current, causing K808 to energize, removing the −105-volt false sense signal from the tune servo amplifier, and allowing the output of the phase detector to assume control of B1002.

(2) FALSE SENSE SIGNAL SWITCH S1206.—At frequencies below 4.0 mc, the rf tuner will not be able to reach a tuning point in the usual way. (Refer to paragraph 2–2.) At such times, rf tuner capacitor C1201 will be at its maximum position. When C1201 is at maximum. microswitch S1206 is closed by motor B1201. This allows −105-volts dc to be applied to the rf tuner phase detector through current limiting resistor R804, closed contacts 16 and 6 of K805 and S1206. This will cause B1202 (rf tuner coil control) to tune the coil, with the result that capacitor C1201 will tune towards minimum to maintain resonance. When this occurs, the false sense signal is no longer required and microswitch S1206, which is closed only at the maximum capacitance position of B1201, will open, removing the false sense signal.

(3) MOTOR LIMIT SWITCHES.—Tuning motors B1002, B1201, and B1202 have limit switches S1003, S1005, S1201, S1202, S1203 and S1204 connected in series with their fields. These are microswitches mechanically connected to the motor shafts by a lead screw mechanism. When the variable components tuned by the motors reach their maximum or minimum positions, the applicable switches will open to remove power from the motors and prevent damage to the components or motors.

2–6. RADIO RECEIVER R–808/GRC–14.

a. OVERALL FUNCTIONAL DESCRIPTION.—Two radio receivers are supplied as components of Radio Set AN/MRC-55. They are identical in design, and are enclosed in watertight cabinets. One receiver may be employed as a standby while the other is operating, or both receivers can be operating at the same time. Signal inputs to the receiver are applied from either a high- or low-impedance antenna which is common to the transmitter, or an independent high- or low-impedance antenna.

The receiver is of the superheterodyne type operating in the frequency range of 2 to 32 mc, covered in the following four bands: 2 to 4 mc, 4 to 8 mc, 8 to 16 mc, and 16 to 32 mc. (The coverage of each band is somewhat greater than listed due to frequency overlap at the extreme ends of each band.) Reception facilities for cw (A1), mcw (A2), phone (A3), and fsk (F1) signals are provided. Provisions are made for simultaneous reception of fsk and phone transmissions on the same frequencies. The receiver is capable of keying a polar or neutral teletypewriter located at a remote site.

It differs from conventional equipments in the following respects: (1) The plate voltage supply for the electron tubes is only +21 volts dc regulated; (2) the frequency-shift converter required for teletypewriter reception is included in the receiver, rather than in accessory equipment; (3) transistors are used, where practical, to reduce heat dissipation.

To allow for two-way relay of communications, the receiver can turn the transmitter on and off automatically for retransmission of received signals when such a service is desired.

As shown in the block diagram, the receiver is conventional in most respects. (See figure 2–29.) The received signal passes through two stages of rf amplification and is then applied to the control grid of the mixer tube. Local injected frequency is obtained from a tunable oscillator followed by a harmonic amplifier. The oscillator is continuously tunable in two ranges of 2.18 to 4.50 mc and 8.65 to 17.75 mc. The harmonic amplifier selects the fundamental oscillator output frequencies for operation on bands 1 and 3 and second harmonies for operation on receiver bands 2 and 4.

When operating on bands 1 and 2 (2 to 8 mc), the difference frequency is applied directly to the input of the 455-kc if. strip. For bands 3 and 4 (8 to 32 mc), the difference frequency is 1500 kc, that must be further mixed in a converter stage to obtain a 455-kc beat signal which is then applied to the if. strip. Provision is also made in the receiver front end to inject a calibration signal at the first rf stage. This frequency is utilized to calibrate the receiver main tuning dial through the use of a movable fiducial pointer.

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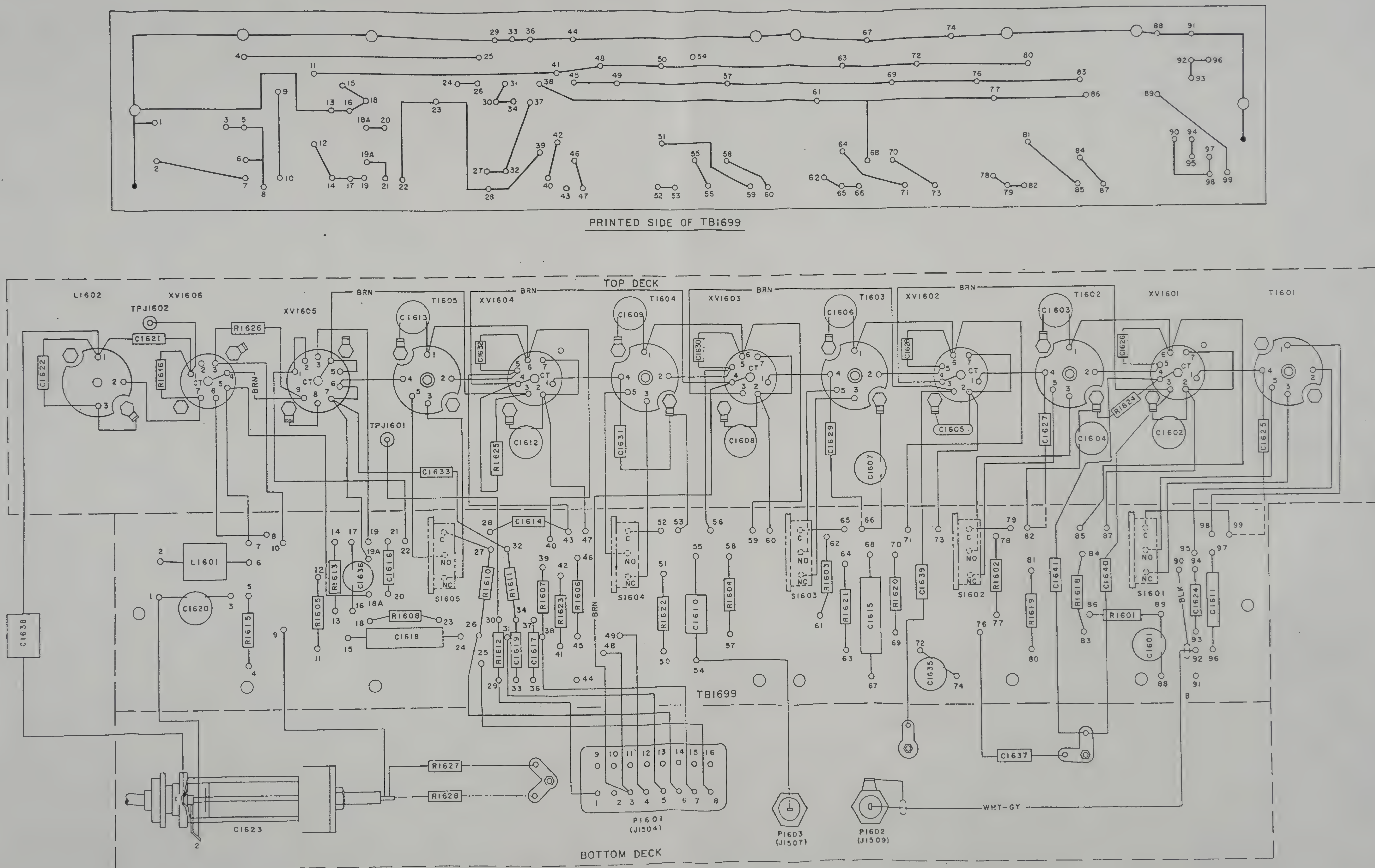


Figure 7-83. Intermediate Frequency Amplifier, Wiring Diagram

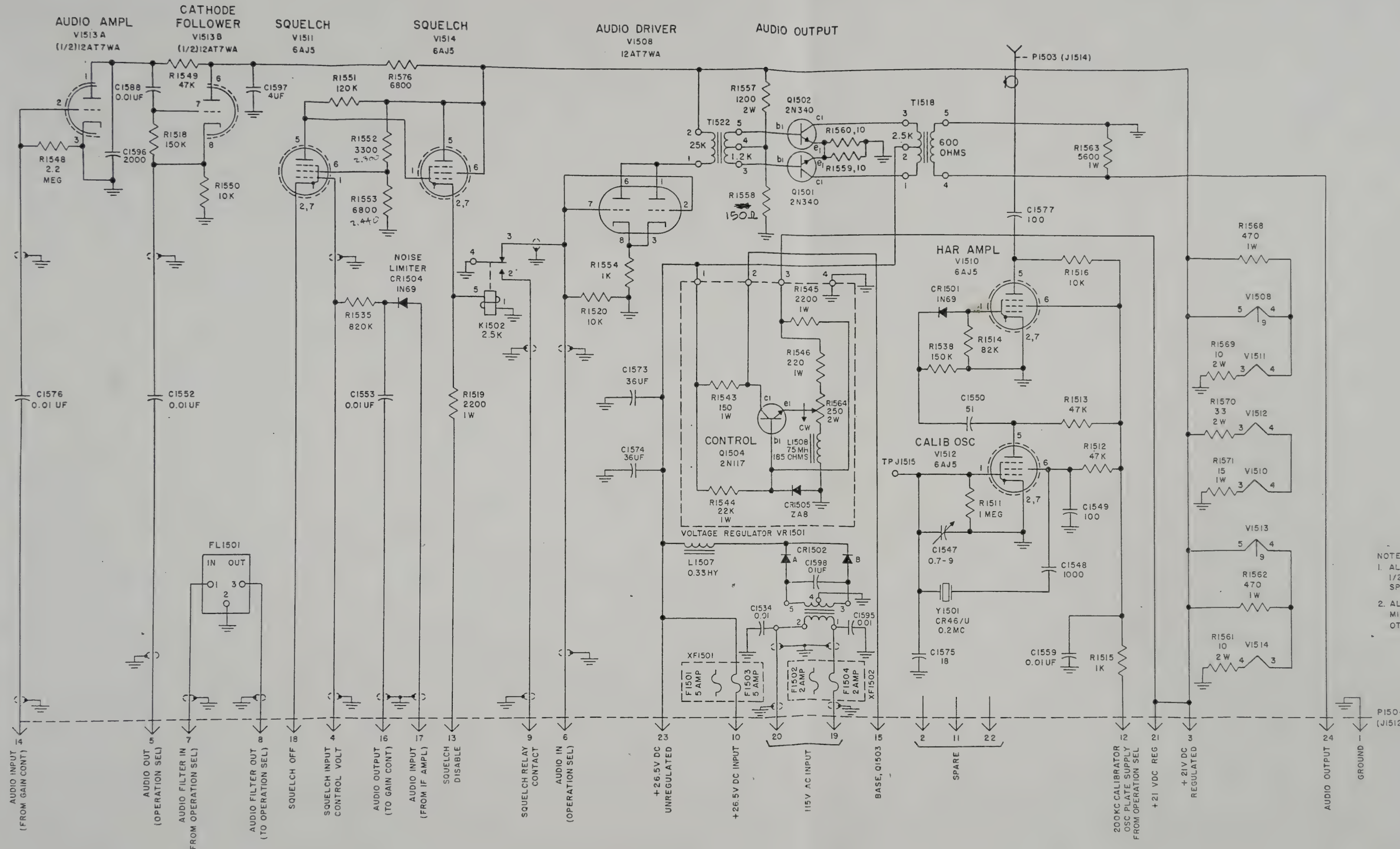
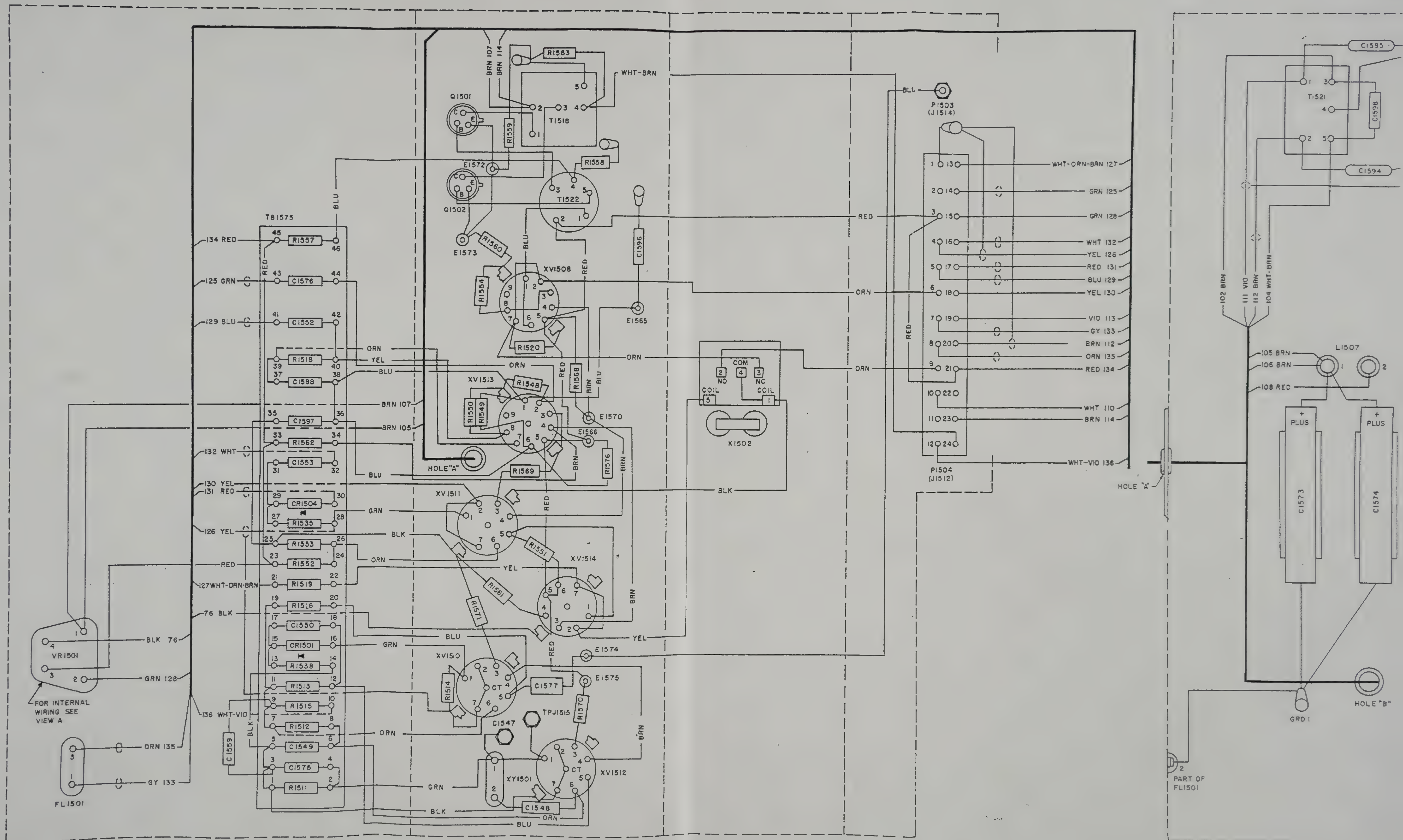


Figure 7-84. Amplifier-Power Supply, Schematic Diagram

NOTES:
1. ALL RESISTORS ARE IN OHMS, 1/2 WATT UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS ARE IN MICRO-MICROFARADS UNLESS OTHERWISE SPECIFIED.


TB1575
Q1501
Q1502
T1518
T1522
E1572
E1573
E1565
E1570
E1566
E1574
E1575
XV1508
XV1513
XV1511
XV1514
XV1510
XV1512
XY1501
TPJ1515
C1547
C1548
K1502
COM
NO
NC
COIL
P1503
(J1514)
P1504
(J1512)
T1521
L1507
C1573
C1574
C1595
C1594
C1598
HOLE "A"
HOLE "B"
GRD 1
PART OF
FL1501
VR1501
FOR INTERNAL
WIRING SEE
VIEW A
FL1501
134 RED
125 GRN
129 BLU
132 WHT
130 YEL
131 RED
126 YEL
127WHT-ORN-BRN
76 BLK
136 WHT-VIO
ORN 135
GY 133
BLK 76
GRN 128
BRN 107
BRN 105
WHT-BRN
WHT-ORN-BRN 127
GRN 125
GRN 128
WHT 132
YEL 126
RED 131
BLU 129
YEL 130
VIO 113
GY 133
BRN 112
ORN 135
RED 134
WHT 110
BRN 114
WHT-VIO 136
105 BRN
106 BRN
108 RED
102 BRN
111 VIO
112 BRN
104 WHT-BRN
PLUS

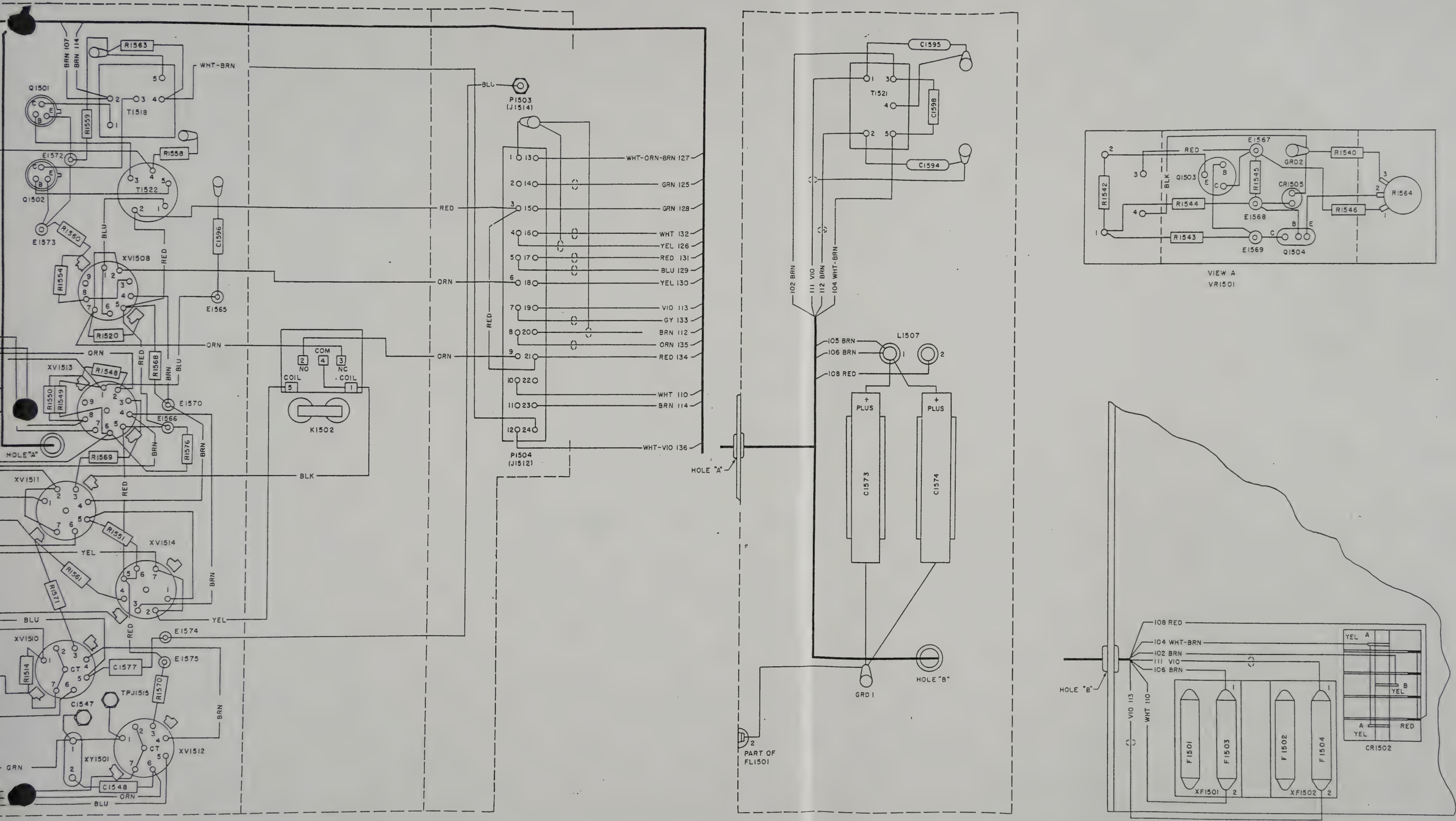


Figure 7-85. Amplifier-Power Supply, Wiring Diagram

ORIGINAL

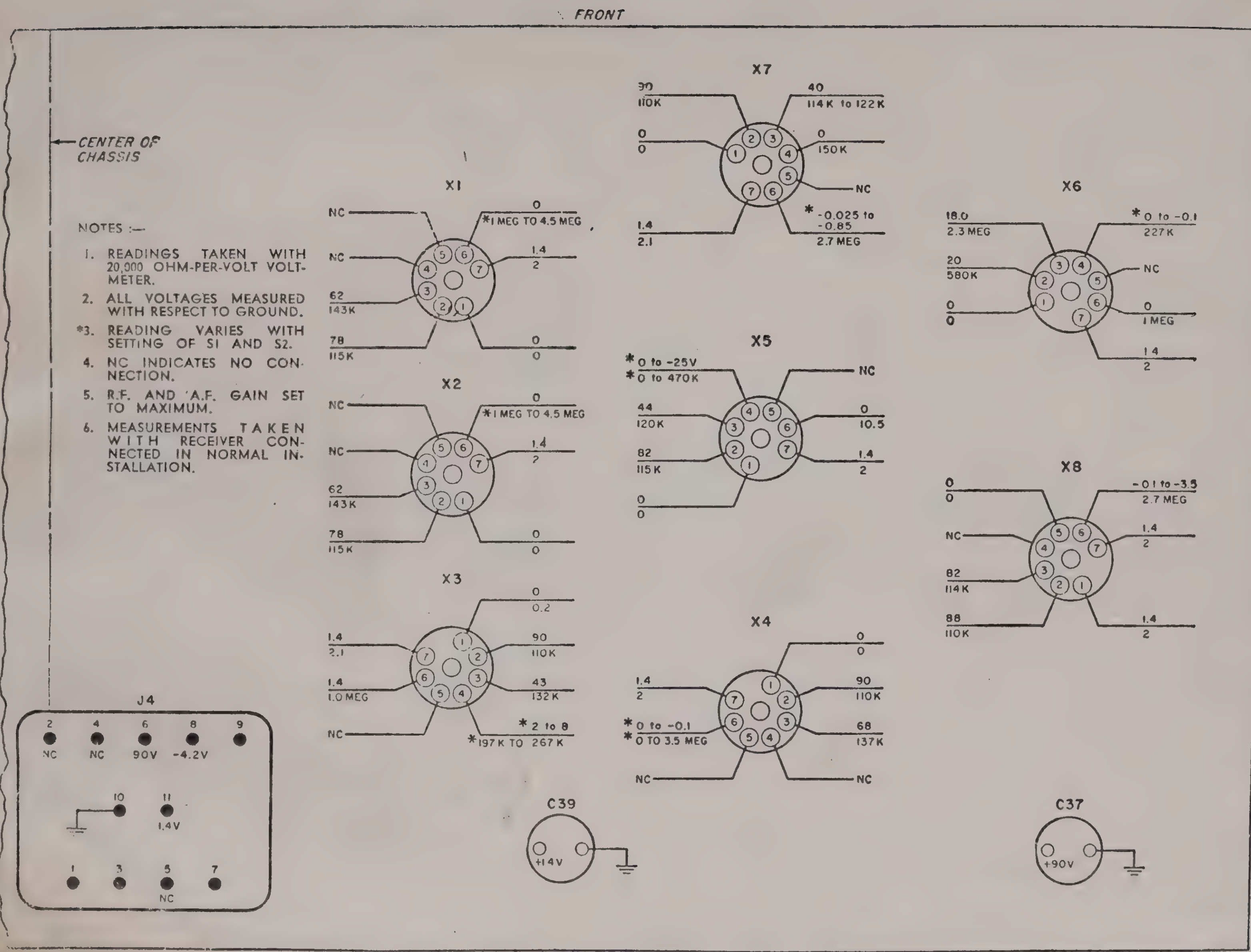
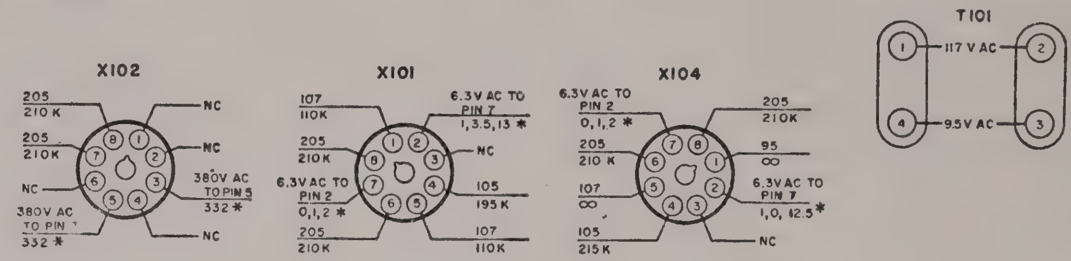


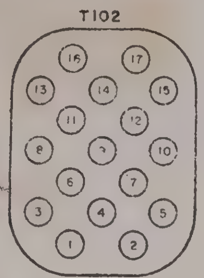
Figure 45. Radio Receiver R-174/URR, tube socket voltage and resistance diagram.

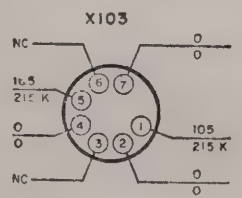
FRONT



T102 VOLTAGE READINGS

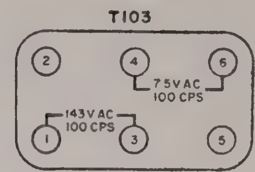
PIN	VOLTAGE
1 & 10	24V PRIMARY } 100 CPS
2 & 9	12V PRIMARY } 100 CPS
3 & 5 (4CT)	6V PRIMARY } 100 CPS
6 & 8 (7CT)	6V PRIMARY } 100 CPS
11 & 12	117 V PRIMARY 50-60 CPS
13 & 15 (14CT)	380V RMS
16 & 17	1.0V RMS





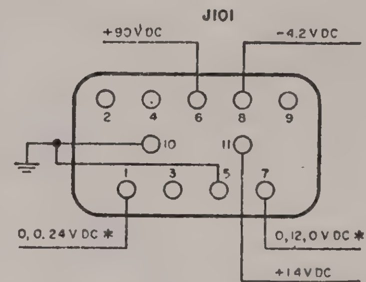
NOTES :

1. UNLESS OTHERWISE INDICATED ALL RESISTANCE VALUES IN OHMS.
2. K=1,000 OHMS.
3. ALL VOLTAGE READINGS MEASURED WITH 20,000 OHM-PER VOLT-METER.
*4. MEASUREMENT FOR 6-12-24V OPERATION RESPECTIVELY.
5. ALL RESISTANCE READINGS MEASURED TO GROUND.
6. NC INDICATES NO CONNECTION.
7. MEASUREMENTS TAKEN WITH POWER SUPPLY CONNECTED IN NORMAL INSTALLATION.
8. ∞ INDICATES INFINITY.



J101 RESISTANCE READINGS

PIN	6V	12V	24V	DRY BATTERY
1	∞	134	16	∞
2	5	5	5	5
3	0	0	0	0
4	5	5	5	5
5	0	0	0	0
6	110K	110K	110K	110K
7	∞	4	150	∞
8	62	62	62	162
9	.6	.6	.6	.6
10	0	0	0	0
11	2	2	2	2



REAR

Figure 44. Power Supply PP-308/URR, tube socket voltage and resistance diagram.

295-49

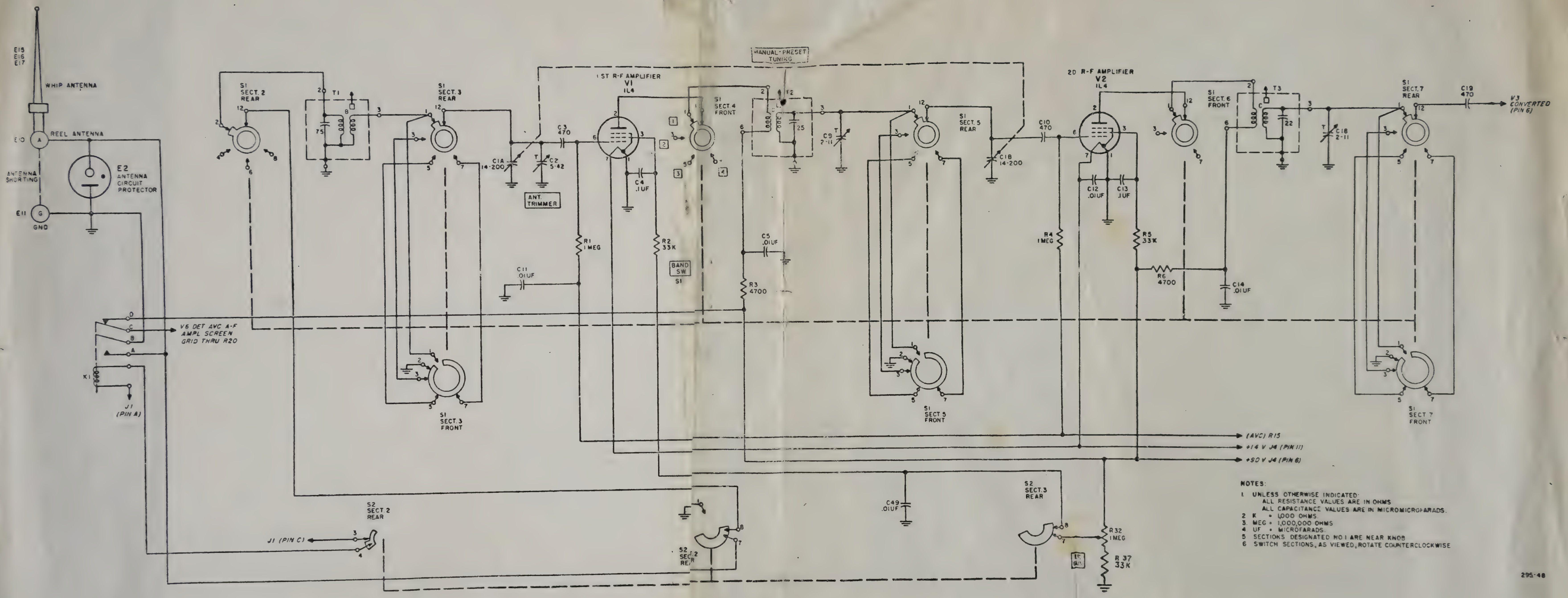


Figure 43. Radio Receiver R–174/URR, r-f amplifiers, for band 1, functional schematic.

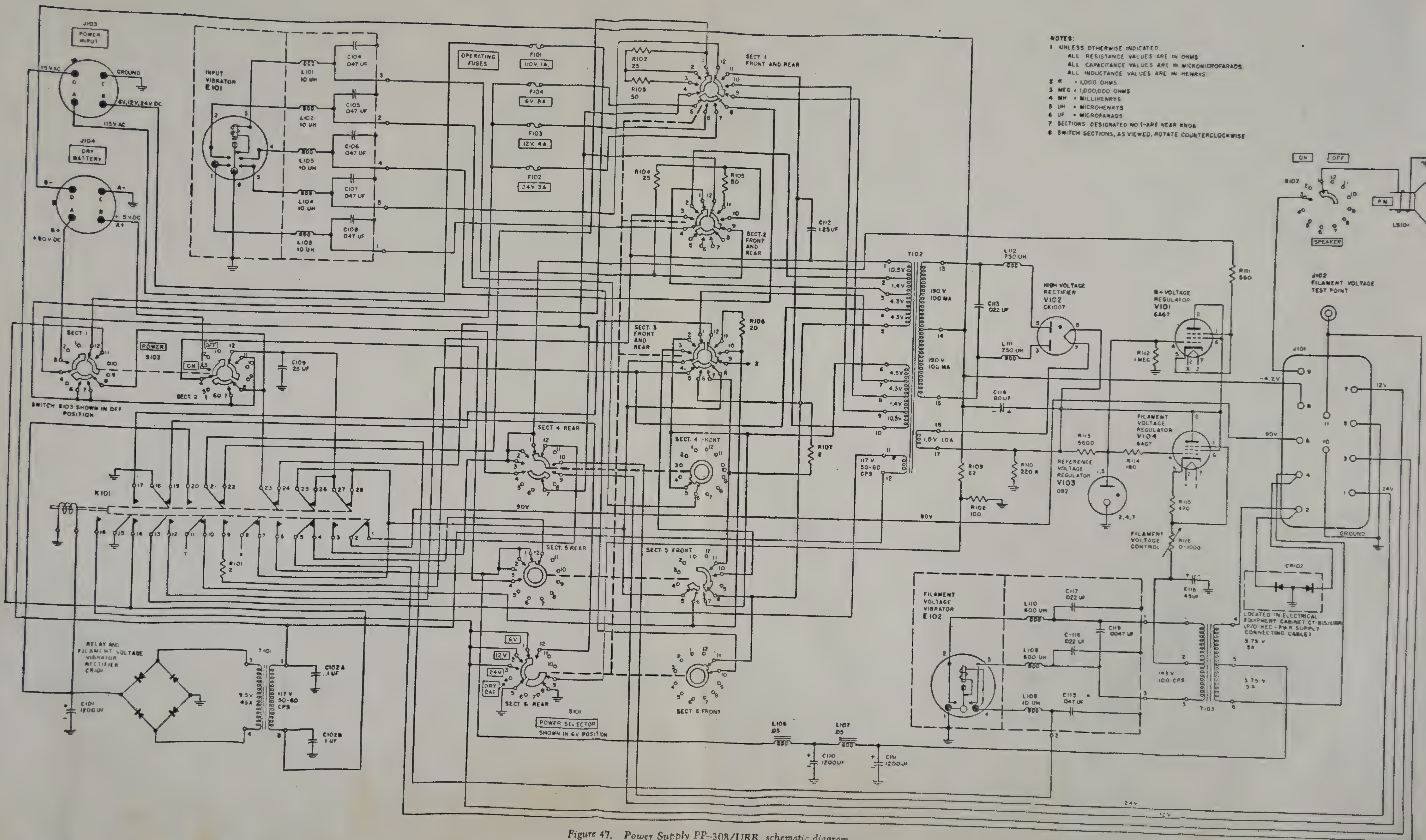


Figure 47. Power Supply PP-308/URR, schematic diagram.

295-46

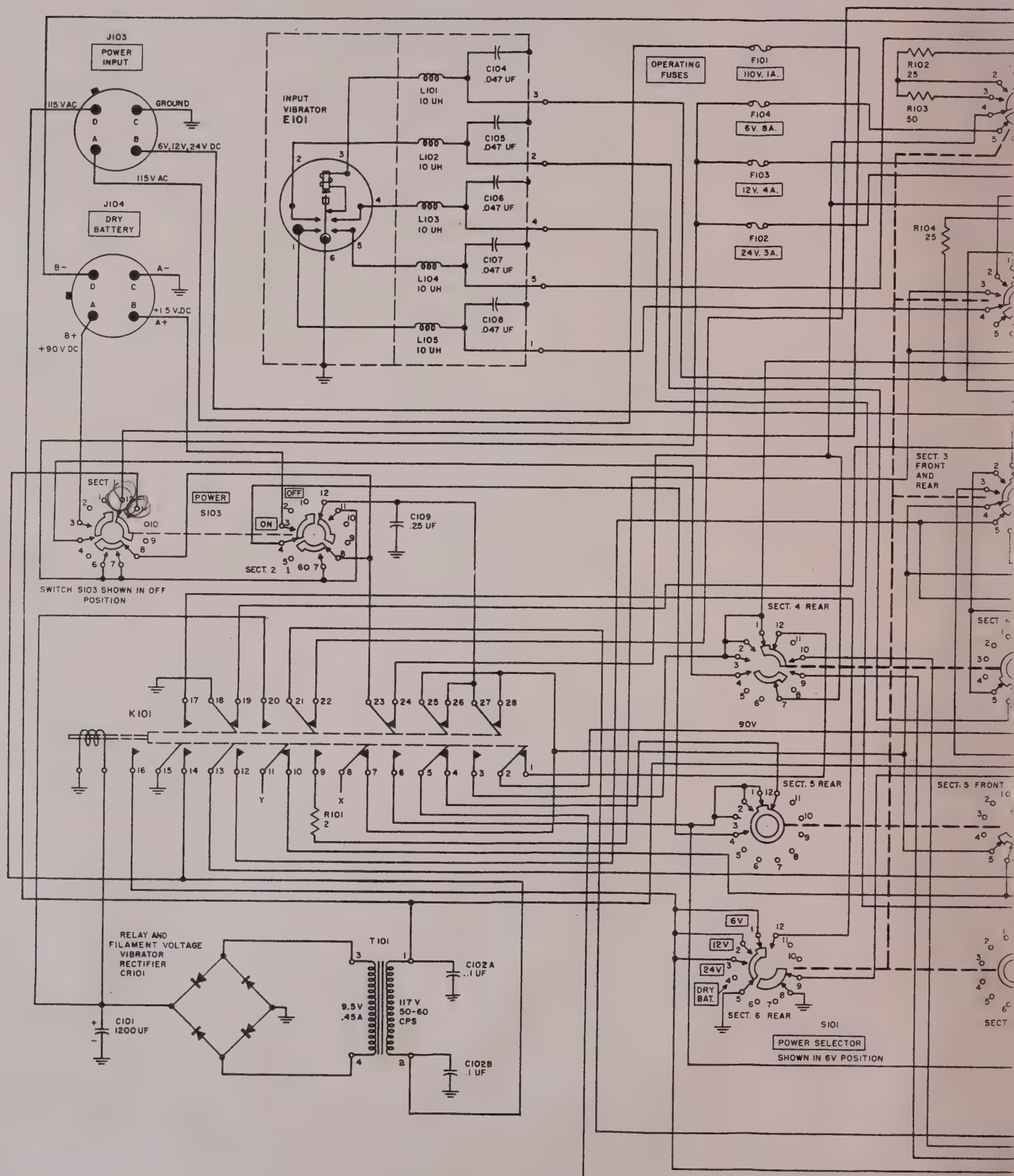


Figure 47. Power Supply P

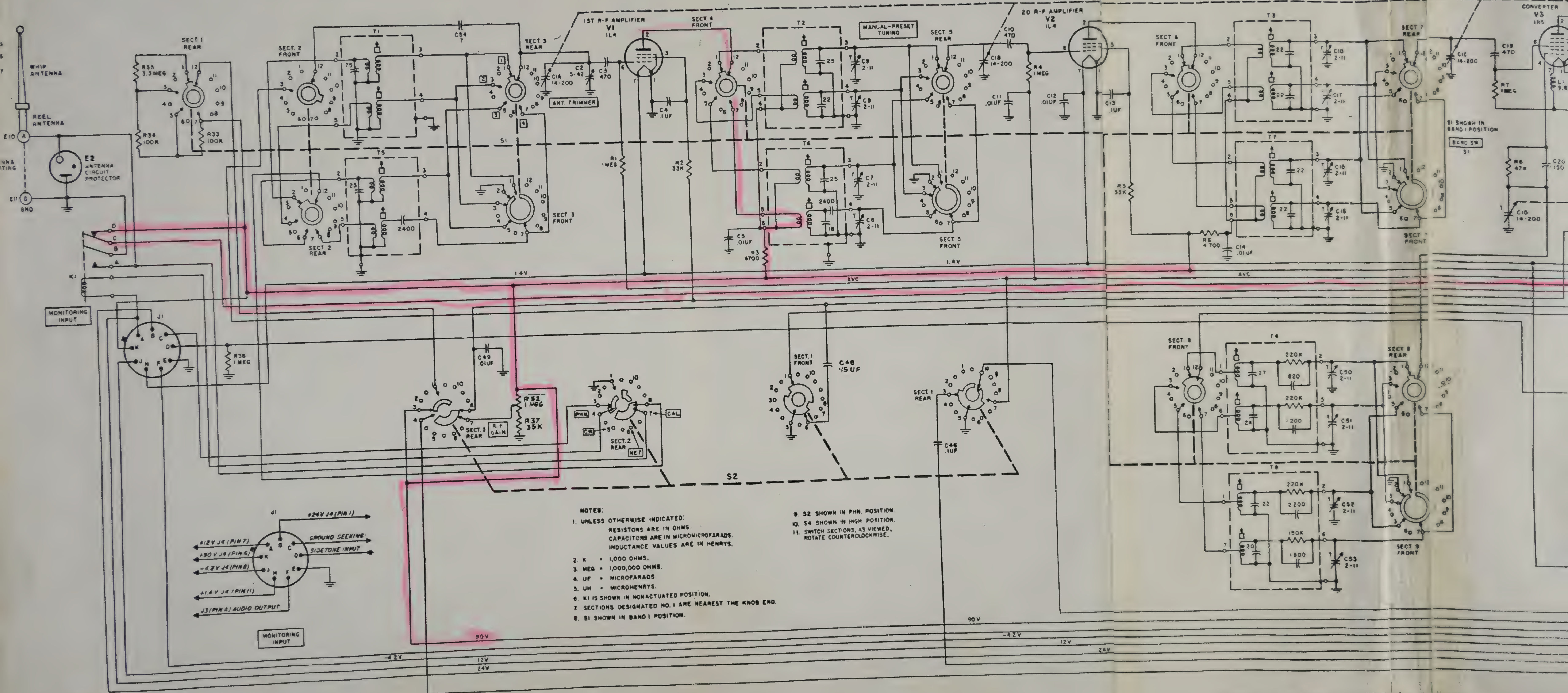


Figure 48. Radio Receiver R-174/URR, schematic diagram.

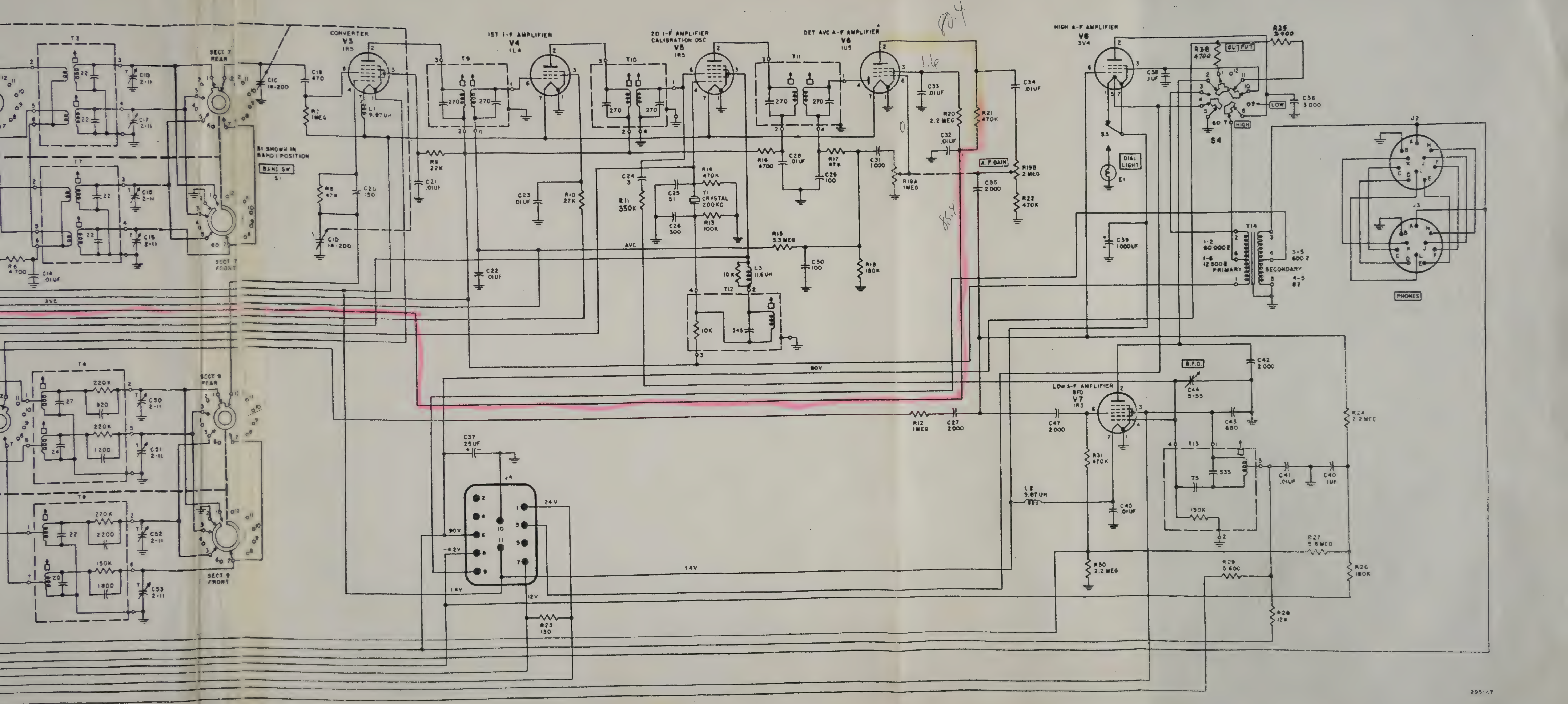
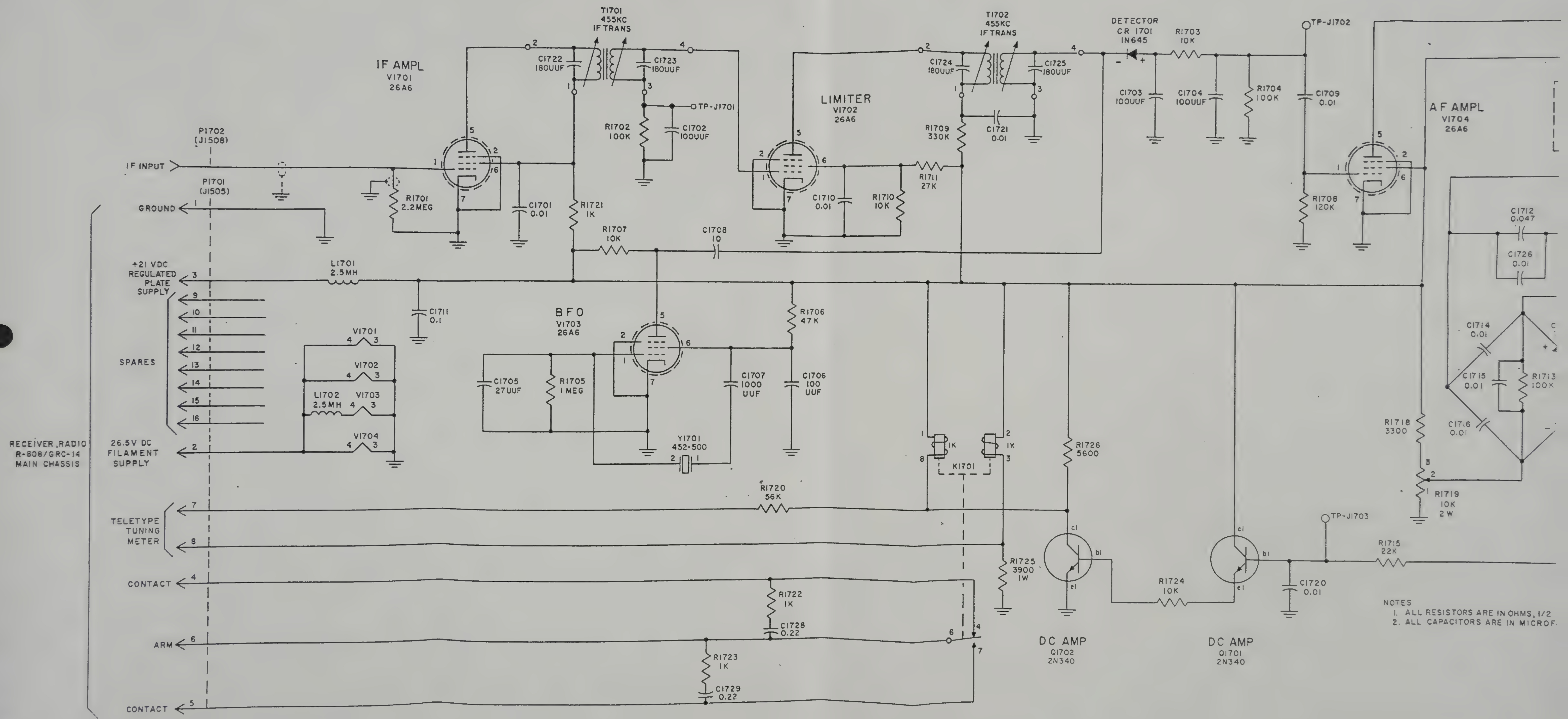
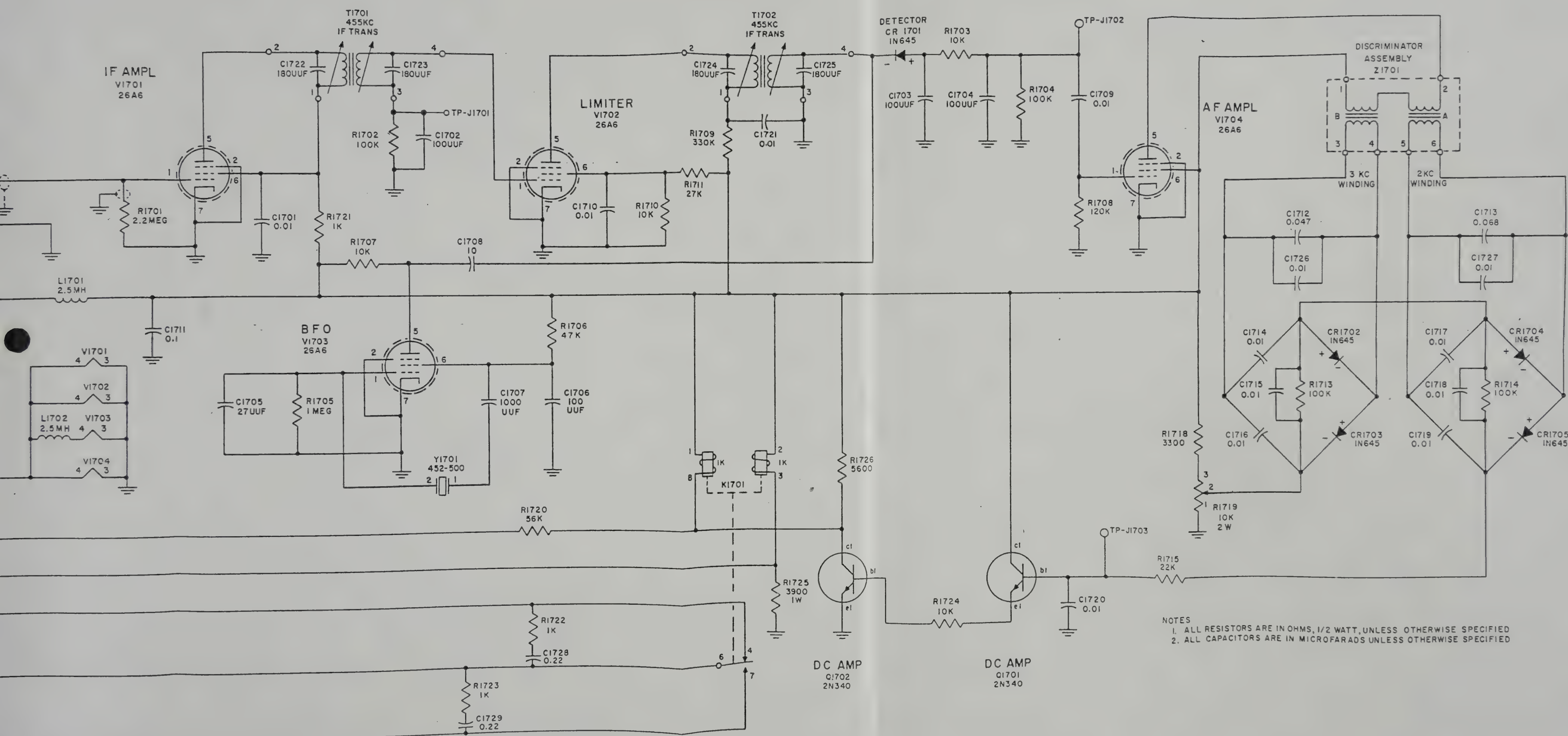


Figure 48. Radio Receiver R-174/URR, schematic diagram.

THIS SCHEMATIC IS APPLICABLE TO FREQUENCY SHIFT CONVERTERS SUPPLIED AS PART OF RECEIVERS HAVING SERIAL NUMBERS 1 THROUGH 115



THIS SCHEMATIC IS APPLICABLE TO FREQUENCY SHIFT CONVERTERS SUPPLIED AS PART OF RECEIVERS HAVING SERIAL NUMBERS 1 THROUGH 115



NOTES
1. ALL RESISTORS ARE IN OHMS, 1/2 WATT, UNLESS OTHERWISE SPECIFIED
2. ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED

Figure 7-86. Frequency Shift Converter, AF Type, Schematic Diagram

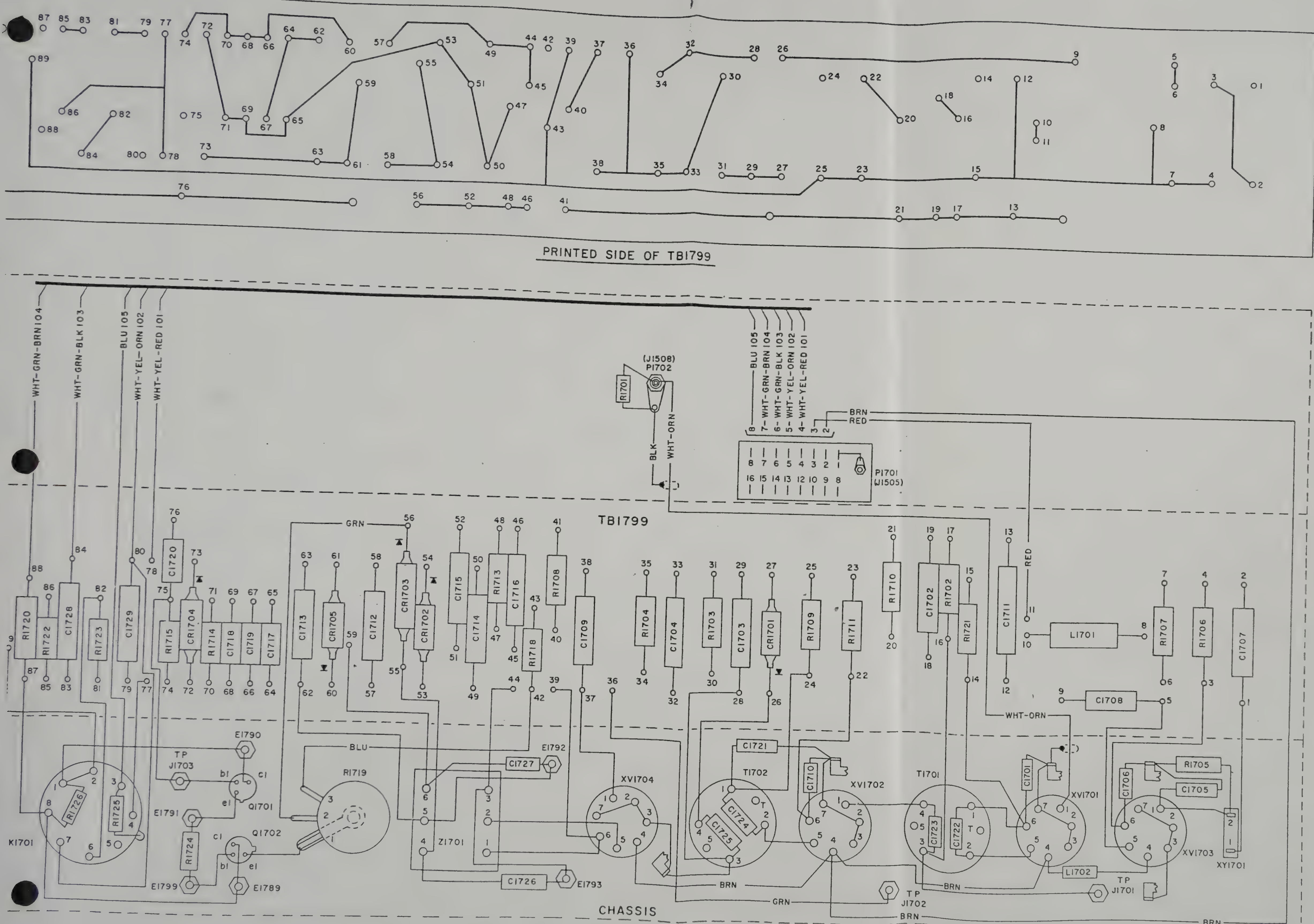
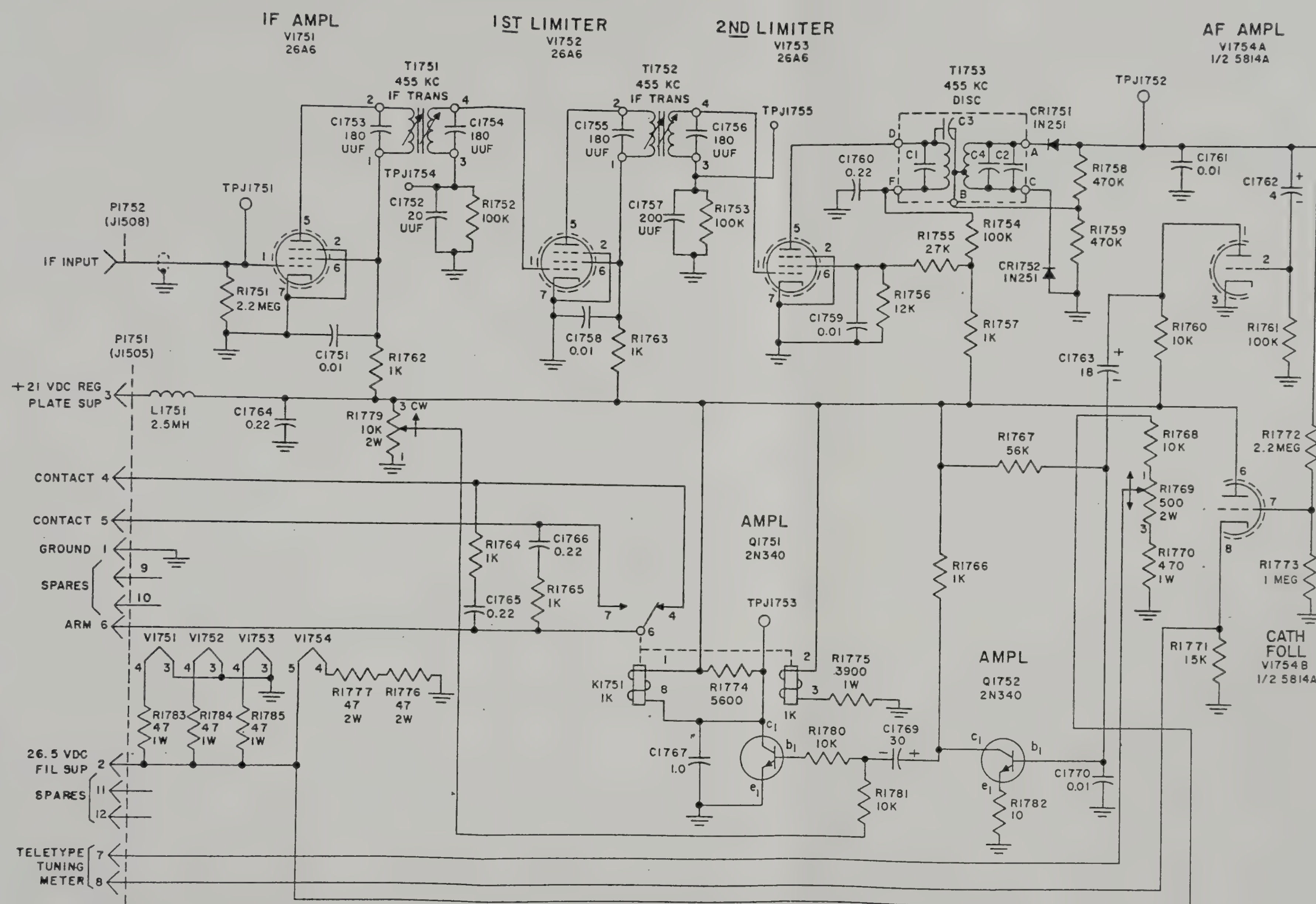


Figure 7-87. Frequency Shift Converter, AF Type, Wiring Diagram



THIS SCHEMATIC IS APPLICABLE TO FREQUENCY SHIFT CONVERTERS SUPPLIED AS PART OF RECEIVERS HAVING SERIAL NUMBERS 116 AND FOLLOWING

NOTES:
1. ALL RESISTORS ARE IN OHMS, 1/2 WATT, UNLESS OTHERWISE SPECIFIED.
2. ALL CAPACITORS ARE IN MICROFARADS, UNLESS OTHERWISE SPECIFIED.

Figure 7-88. Frequency Shift Converter, IF. Type, Schematic Diagram

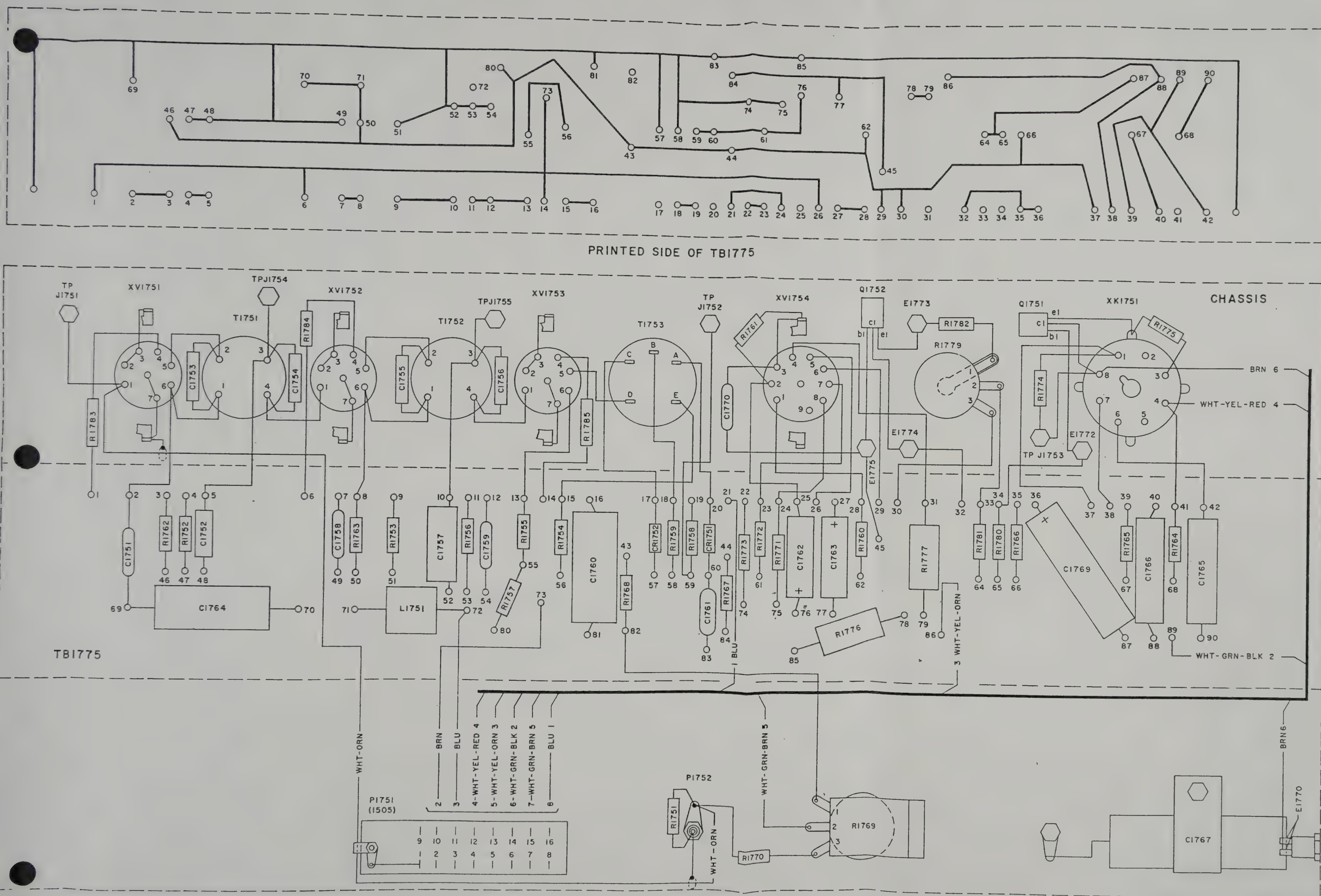


Figure 7-89. Frequency Shift Converter, IF. Type, Wiring Diagram

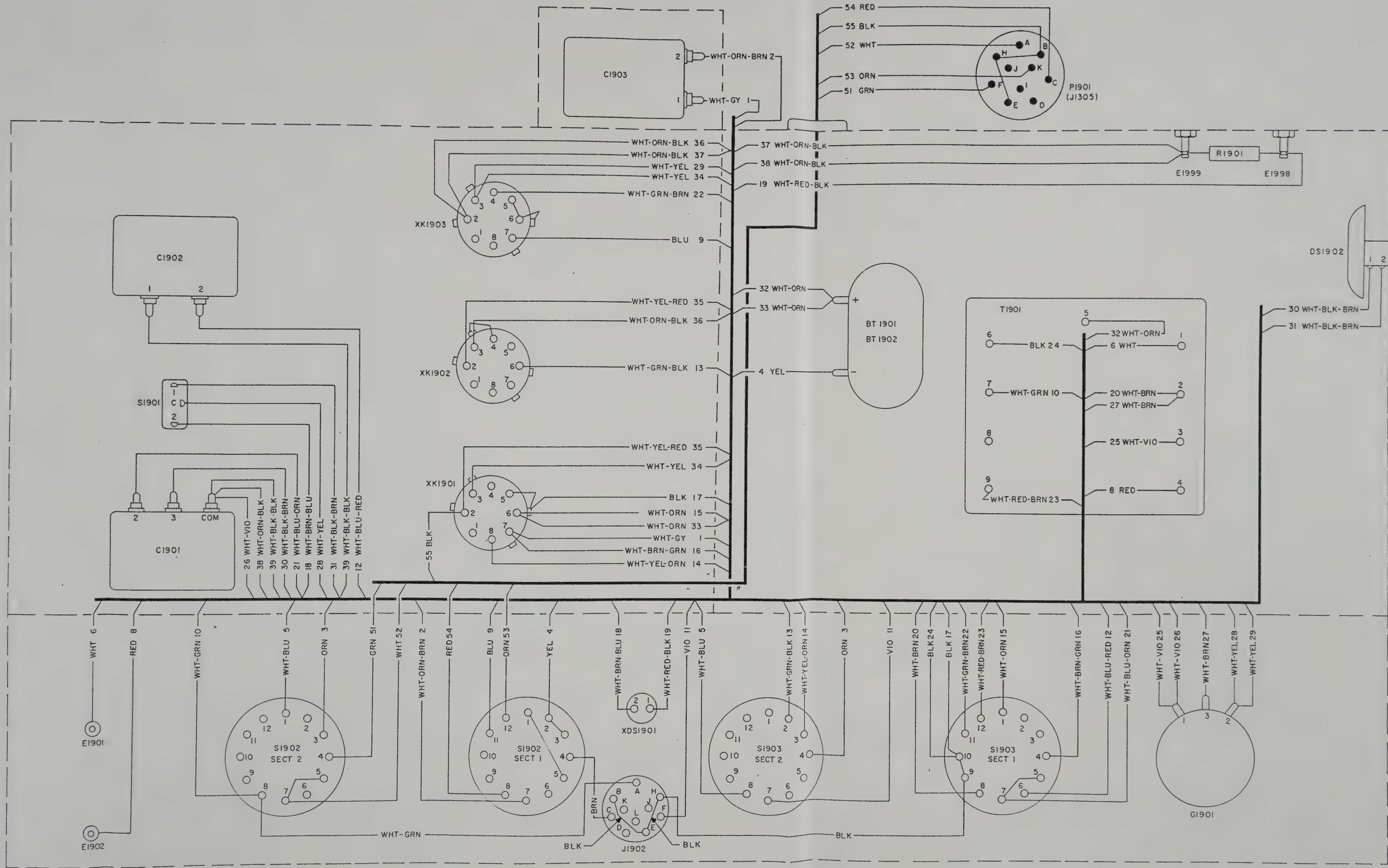
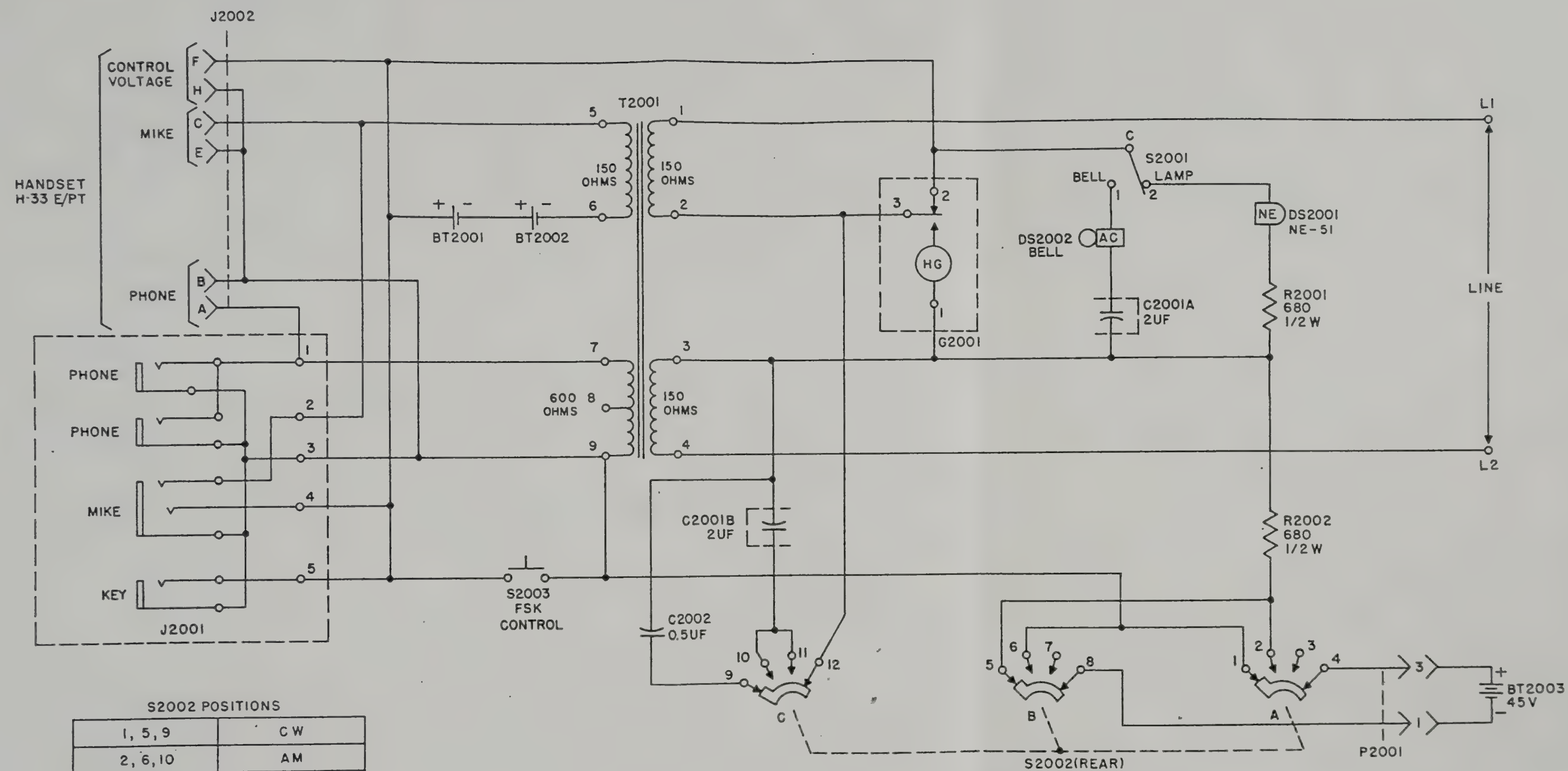


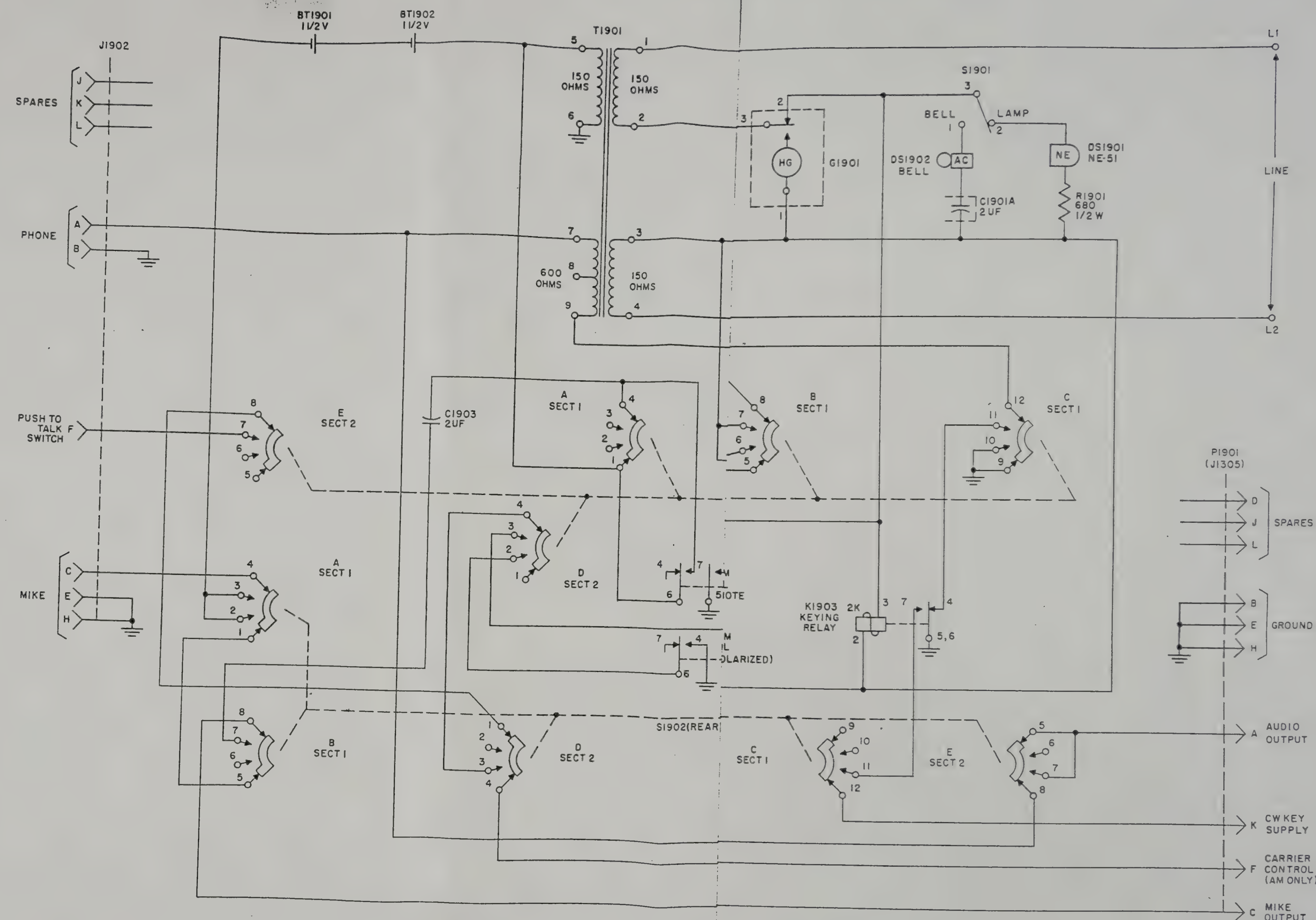
Figure 7-91. Local Remote Control, Wiring Diagram



S2002 POSITIONS

1, 5, 9	CW
2, 6, 10	AM
3, 7, 11	TEL

Figure 7-92. Field Remote Control, Schematic Diagram

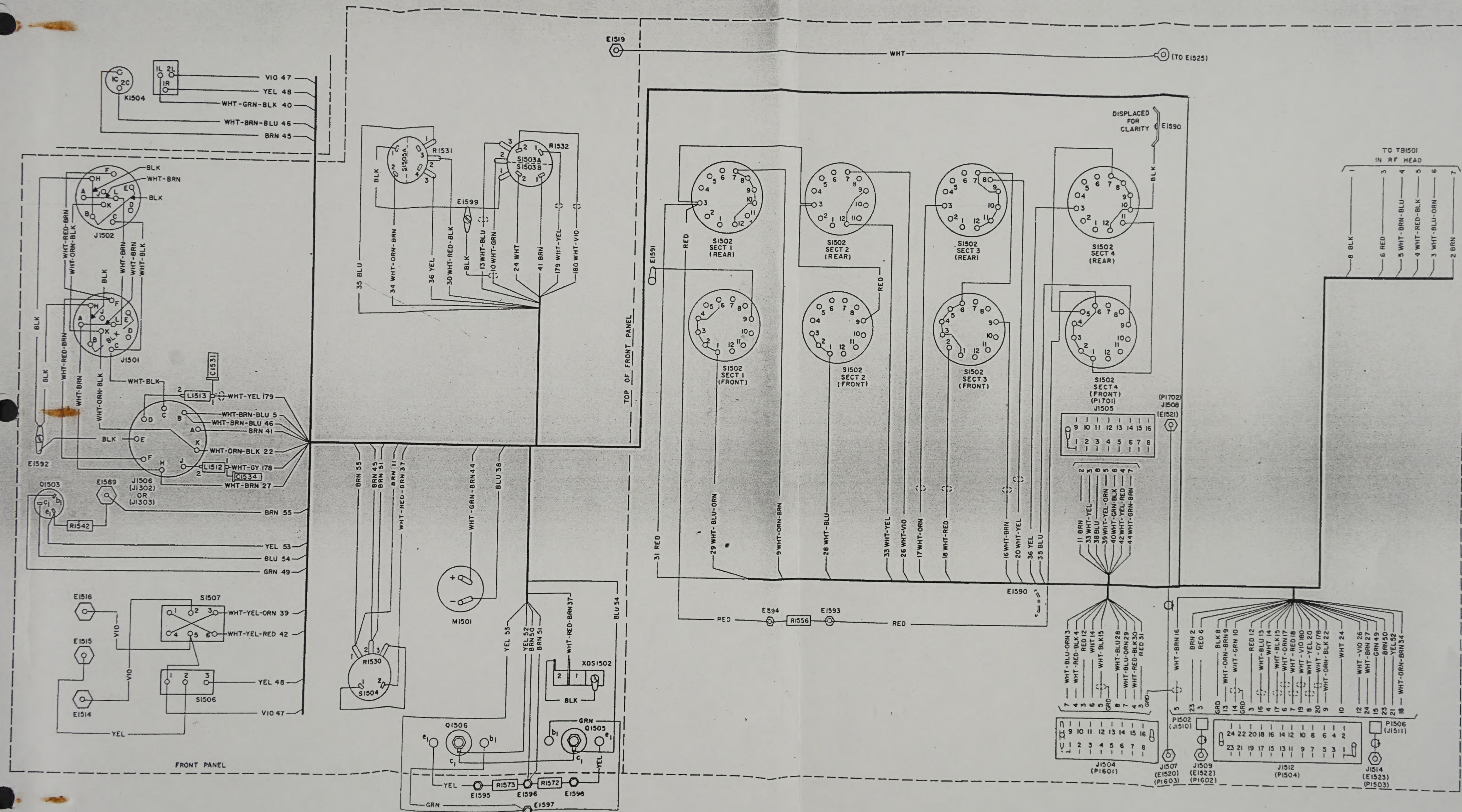


S1902 POSITIONS

1, 5, 9	LOCAL
2, 6, 10	TEL
3, 7, 11	REMOTE

S1903 POSITIONS

1, 5, 9	TEL
2, 6, 10	CW/FSK
3, 7, 11	AM


K1504
J1502
J1501
J1506 (J1302) OR (J1303)
Q1503
E1589
E1592
R1542
L1513
L1512
C1531
C1534
R1531
R1532
S1502A
S1503A
S1503B
E1599
E1519
WHT
(TO E1525)
TOP OF FRONT PANEL
DISPLACED FOR CLARITY
E1590
E1591
S1502 SECT 1 (REAR)
S1502 SECT 2 (REAR)
S1502 SECT 3 (REAR)
S1502 SECT 4 (REAR)
S1502 SECT 1 (FRONT)
S1502 SECT 2 (FRONT)
S1502 SECT 3 (FRONT)
S1502 SECT 4 (FRONT)
(P1701) J1505
(P1702) J1508 (E1521)
TO TB1501 IN RF HEAD
M1501
E1516
E1515
E1514
S1507
S1506
R1530
S1504
XDS1502
Q1506
Q1505
E1595
R1573
E1596
R1572
E1598
E1597
E1594
R1556
E1593
J1504 (P1601)
P1502 (J1510)
J1507 (E1520) (P1603)
J1509 (E1522) (P1602)
J1512 (P1504)
P1506 (J1511)
J1514 (E1523) (P1503)
FRONT PANEL